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SEPTEMBER 2000

NATIONAL GEOGRAPHIC

California Trails

Blazing the
Way West

PLUS: Map
Supplement

Peru's Lost Tombs

Ahead of the
Looters

The Unbeatable Body

What Are the Limits?

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Mentone, the Soul of Texas

RANA THARU

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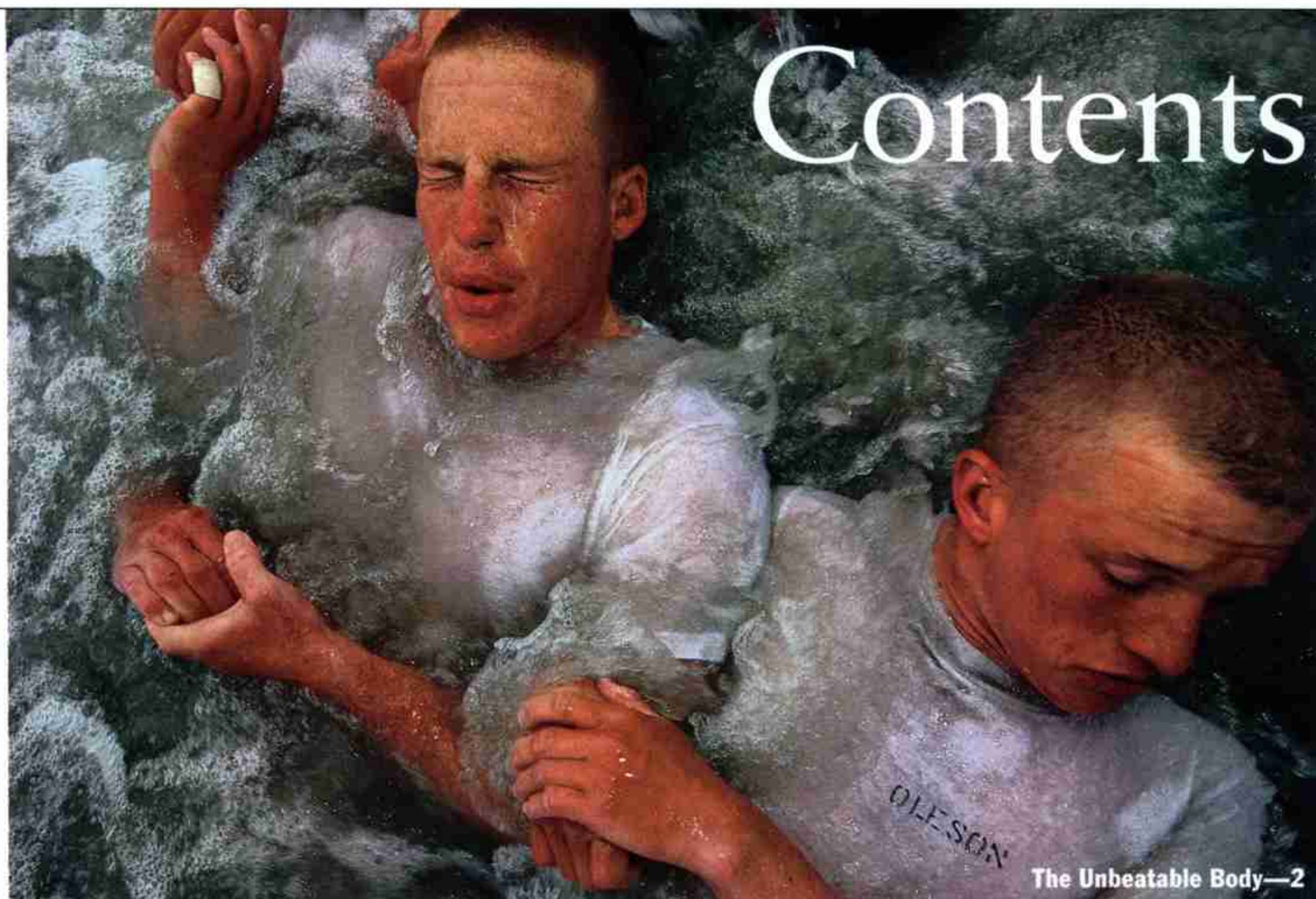
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The Unbeatable Body—2

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Final Edit
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THE COVER

This young Rana Tharu matron belongs to a Himalayan culture where women enjoy a surprising amount of personal freedom.

PHOTOGRAPH BY ERIC VALLI AND DEBRA KELLNER

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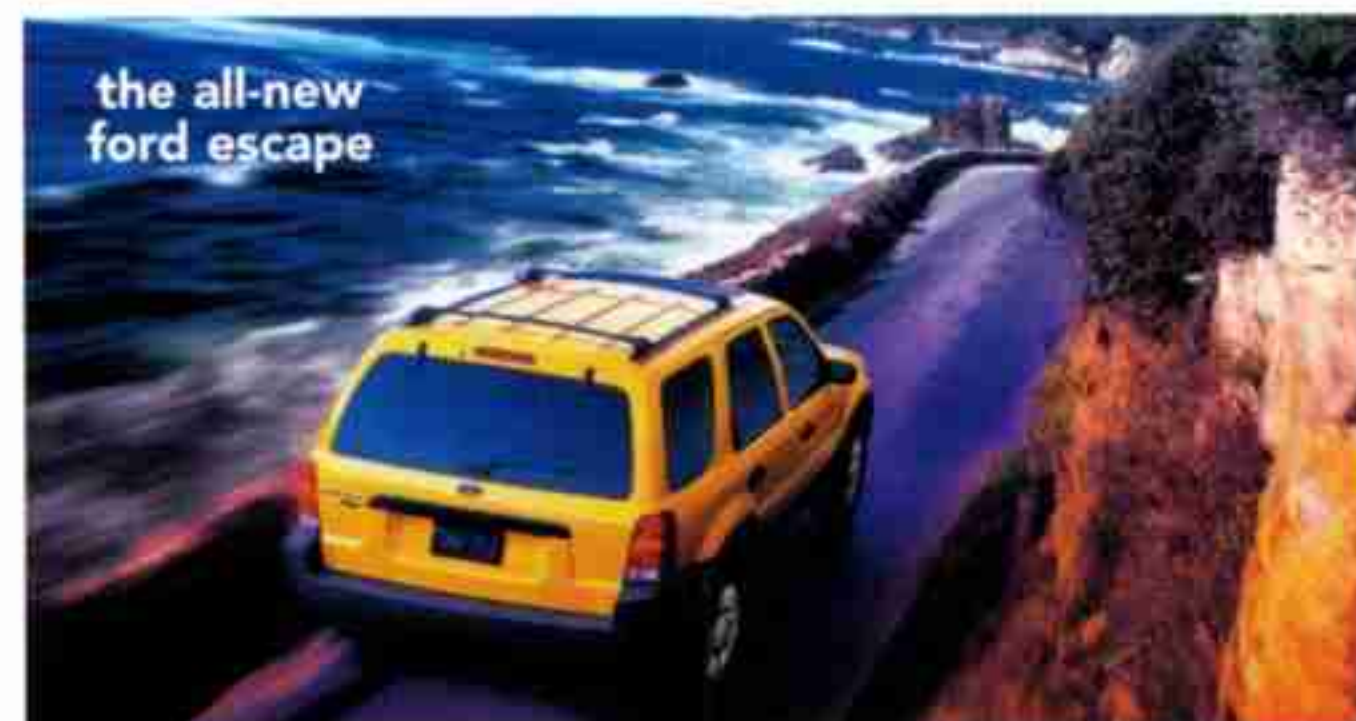
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From the Editor

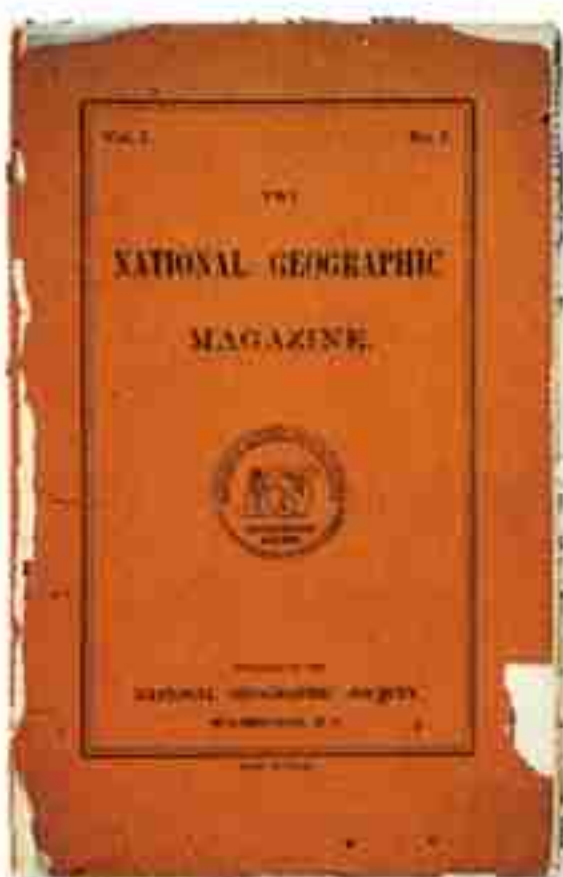


We are still celebrating the awarding to NATIONAL GEOGRAPHIC of the most distinguished prize in magazine journalism—the American Society of Magazine Editors’ “Ellie” for general excellence among magazines of more than one million circulation—presented to us in May of this year.

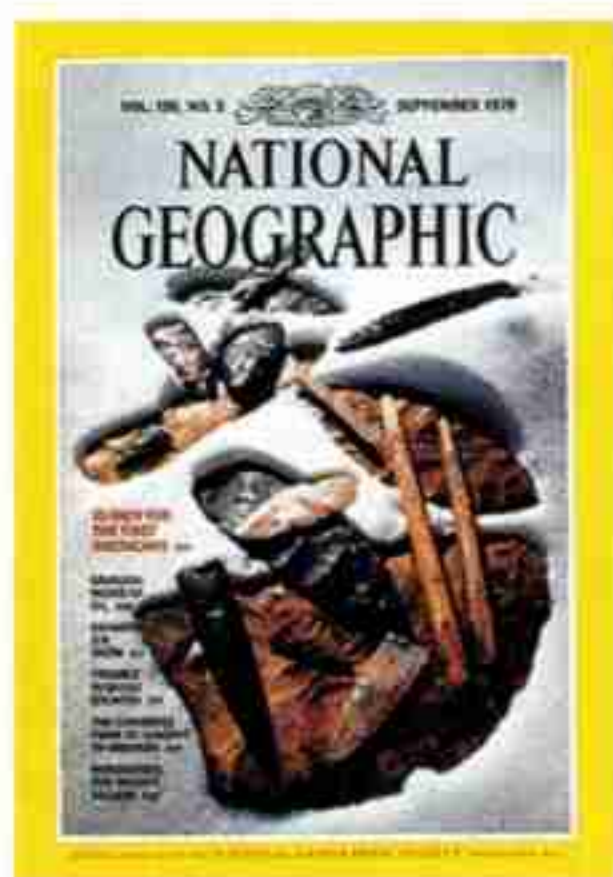
So why change a good thing? As a matter of fact, for the past 112 years this magazine has been constantly changing—in measured steps to be sure. This month we take a measured stride with the new look for our departments (including this page), orchestrated by Senior Editor Constance H. Phelps and her design team. We also inaugurate our new “ZipUSA” series, which will profile a different zip code in each installment. We’d like to hear your suggestions for future zips to visit. The cover, which has undergone its own evolution over the years (below), has a bolder look to help direct you to key features.

Without doubt, NATIONAL GEOGRAPHIC will continue to evolve—in ways that are relevant for you and respectful of our proud heritage.

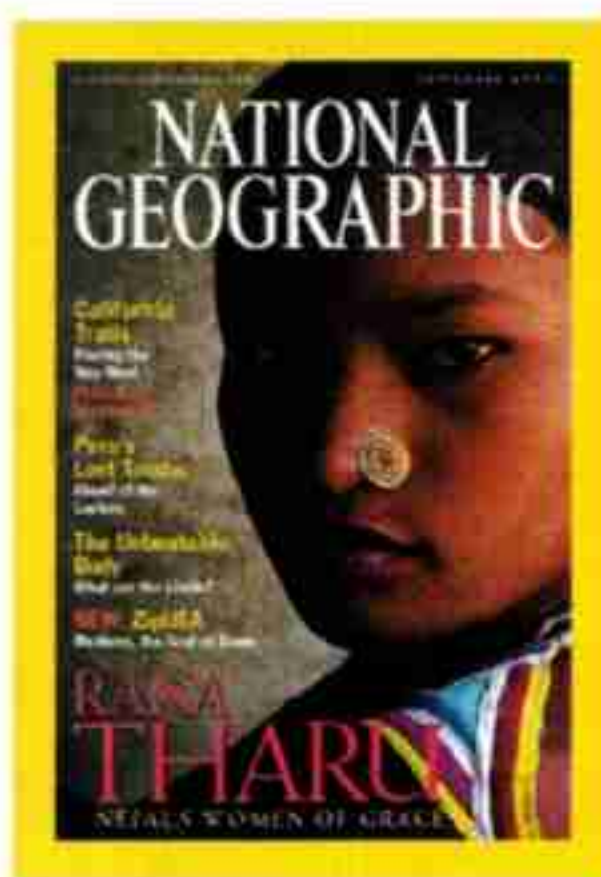
Bill Allen



1888



1979



2000

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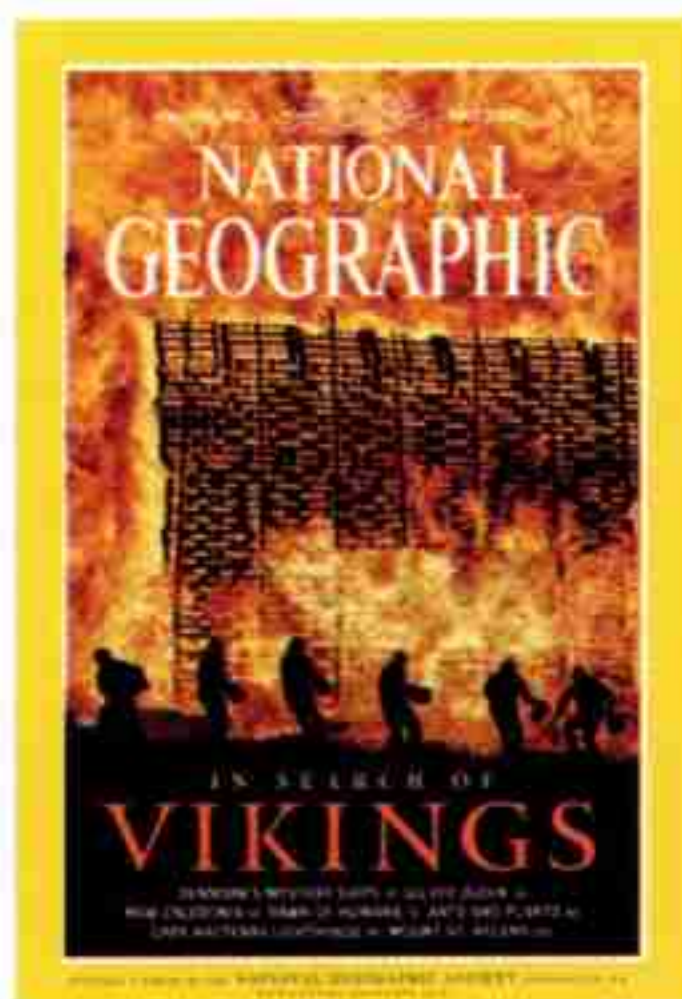
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Forum

May 2000

A stack of old *GEOGRAPHIC* magazines is a standard fixture in many homes around the world. A reader from New York was glad he had kept his when he received the May issue. After reading our follow-up article on the eruption of Mount St. Helens, he picked up the original story, also written by Rowe Findley, from January 1981. "This is why people don't throw away old *GEOGRAPHICS*."



Cape Hatteras Lighthouse

Is it acceptable to spend more than one-third the operating budget of Yellowstone National Park to move a pile of bricks one-half mile, while some of America's ecologically fragile parks are vandalized and left in disrepair for lack of funding?

LINDA TERRELL

Albuquerque, New Mexico

As I approach retirement age, I am impressed that the unified jacking system used to push the lighthouse was designed by a 78-year-old. As an accountant I could not help but notice it cost about \$1.20 a pound to move the lighthouse.

GEORGE A. FIEBELKORN, JR.

Falls Church, Virginia

In Search of Vikings

Probably the biggest mistake made by the Vikings was to upset the church, for it was the monks who had the supreme task of writing history.

MARK FANTINO

San Francisco, California

There's no doubt that the Vikings were a strong and aggressive people, but I have read that they may have had a little assistance from a locally grown

fungus. Bright red with white spots, the fly agaric mushroom was revered by Siberians and Vikings for its energizing and rejuvenating properties and its ability to "eliminate feelings of fatigue . . . in an extremely harsh environment."

ROBERT S. DURKEE

Vashon Island, Washington

The Vikings were no more or less brutal than the rest of their age. Yes, they kept slaves, but so did the Greeks, Romans, Persians, Egyptians, and Chinese. It is unfair and inaccurate to filter a ninth-century culture through 20th-century morality.

BARBARA L. CALLAHAN

Lowell, Massachusetts

The Vikings left a genetic legacy. Alpha 1-antitrypsin deficiency is an often fatal disease that can affect the lungs and liver. A severe form is caused by a genetic variant that originated in Scandinavia and spread during the Viking exploration throughout northern and eastern Europe. Today this legacy, widely underdiagnosed, affects perhaps as many Americans as cystic fibrosis.

BETTINA B. IRVINE

Director, Alpha 1 Association

Minneapolis, Minnesota



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PETER McBRIDE

Queen of the African Sky

As a pilot for US Airways, I could not help but notice the picture on pages 48-9 [above] of the *Silver Queen* biplane nearly crashing. The pilot said a gust of wind caught the aircraft and despite his best efforts the plane's wing struck the ground. I noticed that the ailerons (the wing controls that roll the aircraft right or left) were positioned (by pilot control) in the direction that

would make the wing strike the ground. There may be more to this story than meets the eye.

RON HAYNES
Hudson, Florida

When the plane touched down, the gust blew the left wing up, so the first point of contact was the right aileron outboard control horn. As it dug into the dirt, it forced the ailerons into the position opposite the one that would be used to correct for the wind.

Last year the Vimy flew over my home in Wales, the BMW engines creating a racket out of all proportion to the sedate and lumbering progress being made. Within weeks of that treat, the residents of Caerphilly were once again given an aeronautical eye-ful when a USAF B-1 supersonic bomber flew over. What good

fortune to be able to see from one's garden the huge progress made in aviation.

LARRY CALEY
Caerphilly, Wales

Mark Rebholz and John LaNoue are to be congratulated on their great achievement in emulating the flight of the South African pilots Pierre van Ryneveld and Quintin Brand. Van Ryneveld was knighted for this flight and is recognized as the "father" of the South African Air Force.

HANS BUSSCHER
Johannesburg, South Africa

Should anyone take on the Vimy again for another adventure, you must tell your readers in advance so we can pray for them!

FINN BENDIKSBY
Oslo, Norway

I disagree with the suggestion that the rise of Christian nation-states at the close of the Middle Ages caused individual freedom, as purportedly cherished by the Vikings, to become "an outlaw creed." Most Vikings probably did not enjoy a significantly greater degree of personal freedom under their chieftains than did subjects of other medieval European kingdoms.

WILLIAM J. FERGUSON
Reynoldsburg, Ohio

Recently Canada Post paid homage to the Viking achievement by issuing a stamp,

choosing a longboat as its main illustration. It's taken over a thousand years, but these medieval explorers have finally received their due.

ALEX LARKIN
East Norriton, Pennsylvania

New Caledonia

Thank you for not self-censoring the photo of top-free Western Caucasian women on a New Caledonia beach (pages 56-7). This is a welcome break from the ethnocentricity of the past, when only "primitive" women of color were shown bare-breasted.

MATTHEW KERWIN
Chelsea, Michigan

men—in NATIONAL GEOGRAPHIC, nudity in primitive cultures is hardly intended to titillate but has a degree of innocence about it. These cultures are not sexually charged or obsessed like our own.

DAVE RUSSELL
Clarkston, Michigan

The beach in your article was Anse Vata. During World War II it was populated by soldiers and sailors, all properly clothed, and—unfortunately—no women.

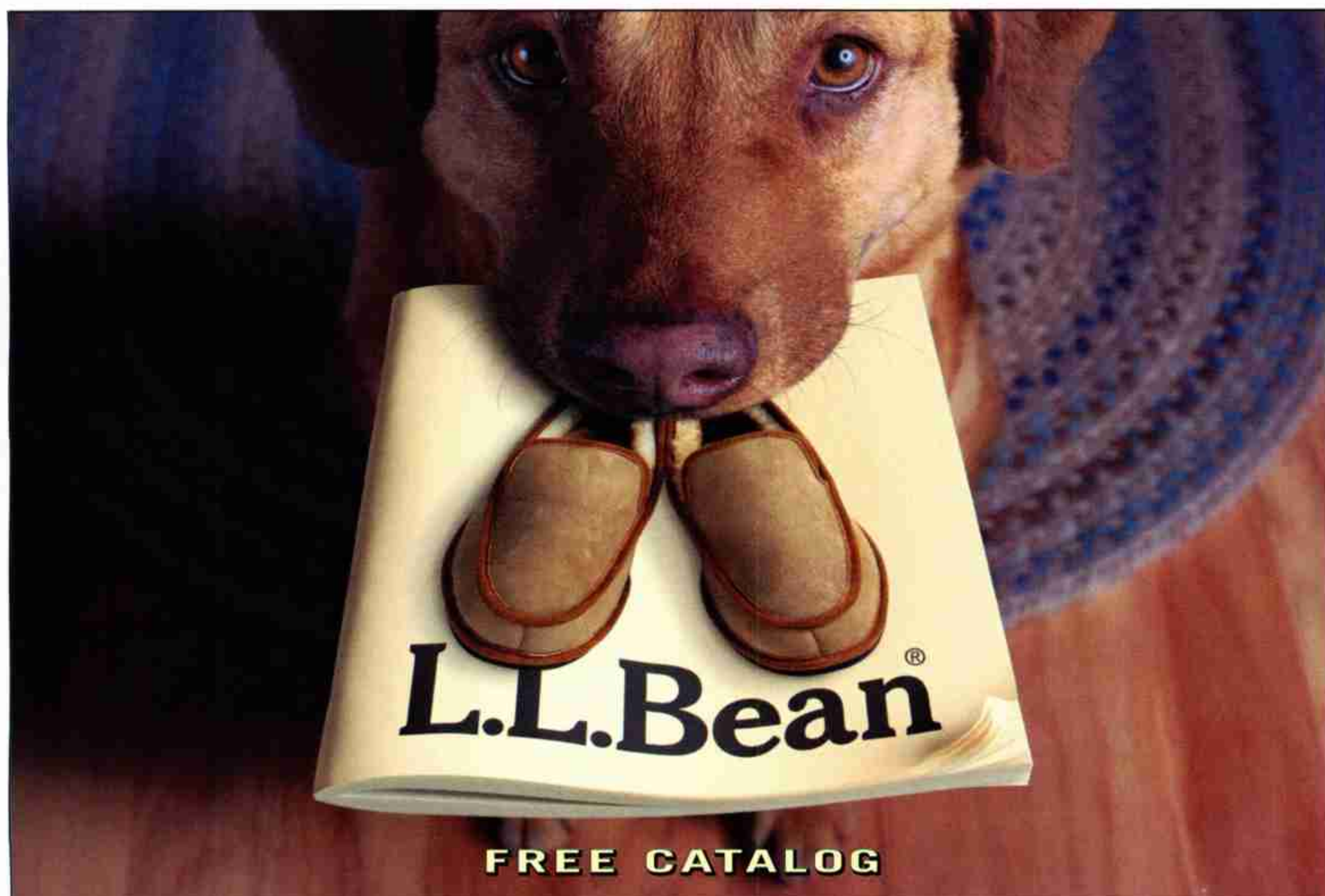
GEORGE WASSERMAN
Brookline, Massachusetts

I was stationed on New Caledonia in 1944 and '45. The mess sergeant for our unit had formerly been a chef at a New York City restaurant. Occasionally we were served venison, obviously not government-issue food. It seems that one of the local farmers lived in a house with a

Pardon me if I sound like a puritanical prude, but I found your inclusion of topless French women to be less than classy. While there have been many photographs of topless women—and sometimes fully naked

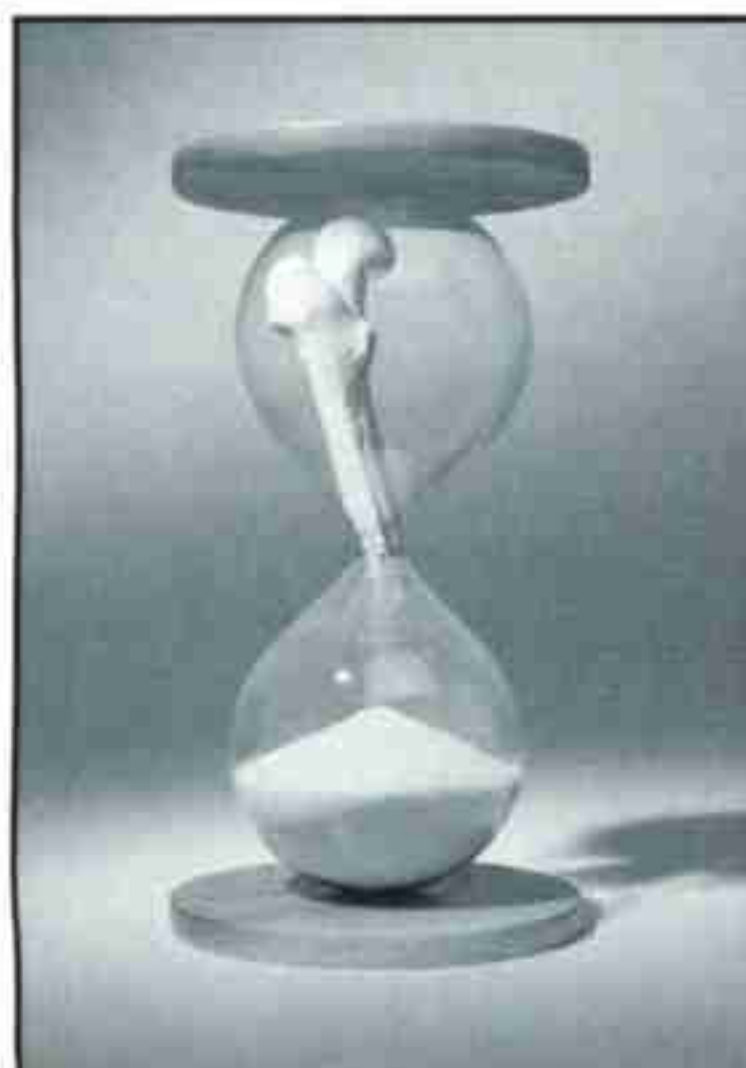
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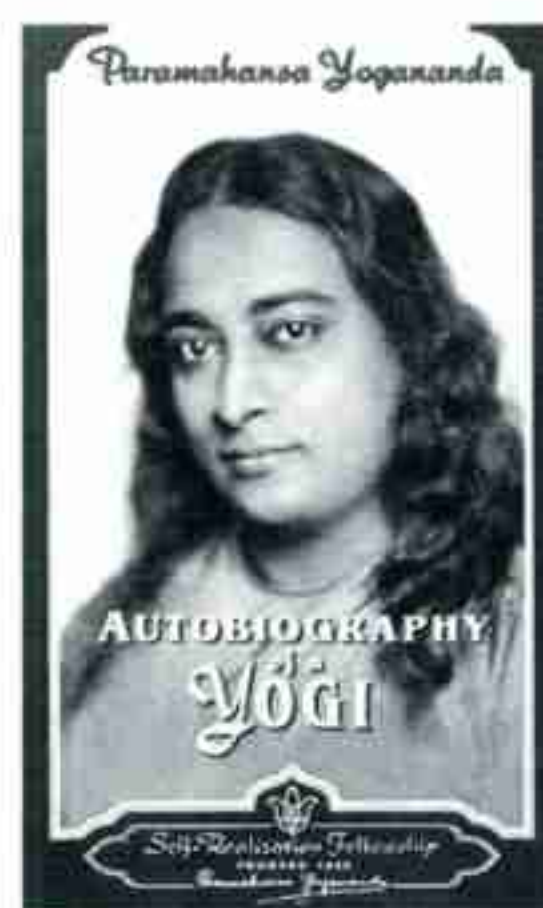
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big back porch overlooking a clearing adjacent to a large forested area. He had trained his dogs to flush deer from the woods. He didn't have to leave his porch to shoot the deer, which he then sold to our sergeant.

ELIAS LISMAN
Westfield, New Jersey

My grandfather was one of the 75,000 Americans stationed in Nouméa during World War II. Shortly after the war ended, he returned to the island to keep his promise to my future grandmother. She was one of 68 women to marry an American and become a proud citizen of the United States.

COLIN HIGGINS
Maple Grove, Minnesota

I know we live in a topsy-turvy world, but are those mullet shown on pages 70-71 swimming upside down?

VINCE ABBOT
Williamsburg, Virginia

The mullet are swimming right-side-up, but their low-set eyes and high-set pectoral fins make them look upside down.

You printed an article on New Caledonian botany with only one interesting picture of a New Caledonian plant. Fascinating.

DAVID REGIER
Bonsall, California

You refer to the notu as the world's largest pigeon. At 51 centimeters, the notu is far smaller than New Guinea's three species of crowned pigeons, which are the largest of all pigeons.

MARTIN EDWARDS
Kingston, Ontario

We should have qualified the statement. The notu is the world's largest arboreal pigeon.

One of my father's favorite memories of the time he spent with the U.S. Army Corps of Engineers in New Caledonia during World War II was the day his commanding officer, in charge of a battalion of African-American troops (the Army was then segregated), liberated the indentured Vietnamese slave laborers owned by a local Vichy tin miner.

MICHAEL LAMB
Chimayo, New Mexico

Mount St. Helens

My family and I were camping in Chehalis, Washington, not far from the mountain, on May 30, 1980, when the second eruption occurred. We thought rain was pelting our tent while thunder and lightning rolled across the hillsides—until we poked our heads outside. The

When rain began to mix with the ash, the ground became instant banana peel, the electricity became erratic, and only black coffee washed ash off the windshield.

ash was falling so thick and fast we felt as if we were inside a vacuum cleaner bag. We bundled up our young sons, wrapped their faces in clean cotton diapers, and hustled to the car. We drove to the nearest motel through ash that was level with the bottom of our car doors.

When rain began to mix with the ash, the ground became instant banana peel, the electricity became erratic, and only black coffee washed ash off the windshield. After three days we were allowed to drive to our home, where we discovered 40 pounds of ash in the hastily packed tent and no wheel bearings on our new car. I have survived two tornadoes, a few hurricanes, many earthquakes, a range fire, and a flash flood, but only Mount St. Helens has struck terror in my heart.

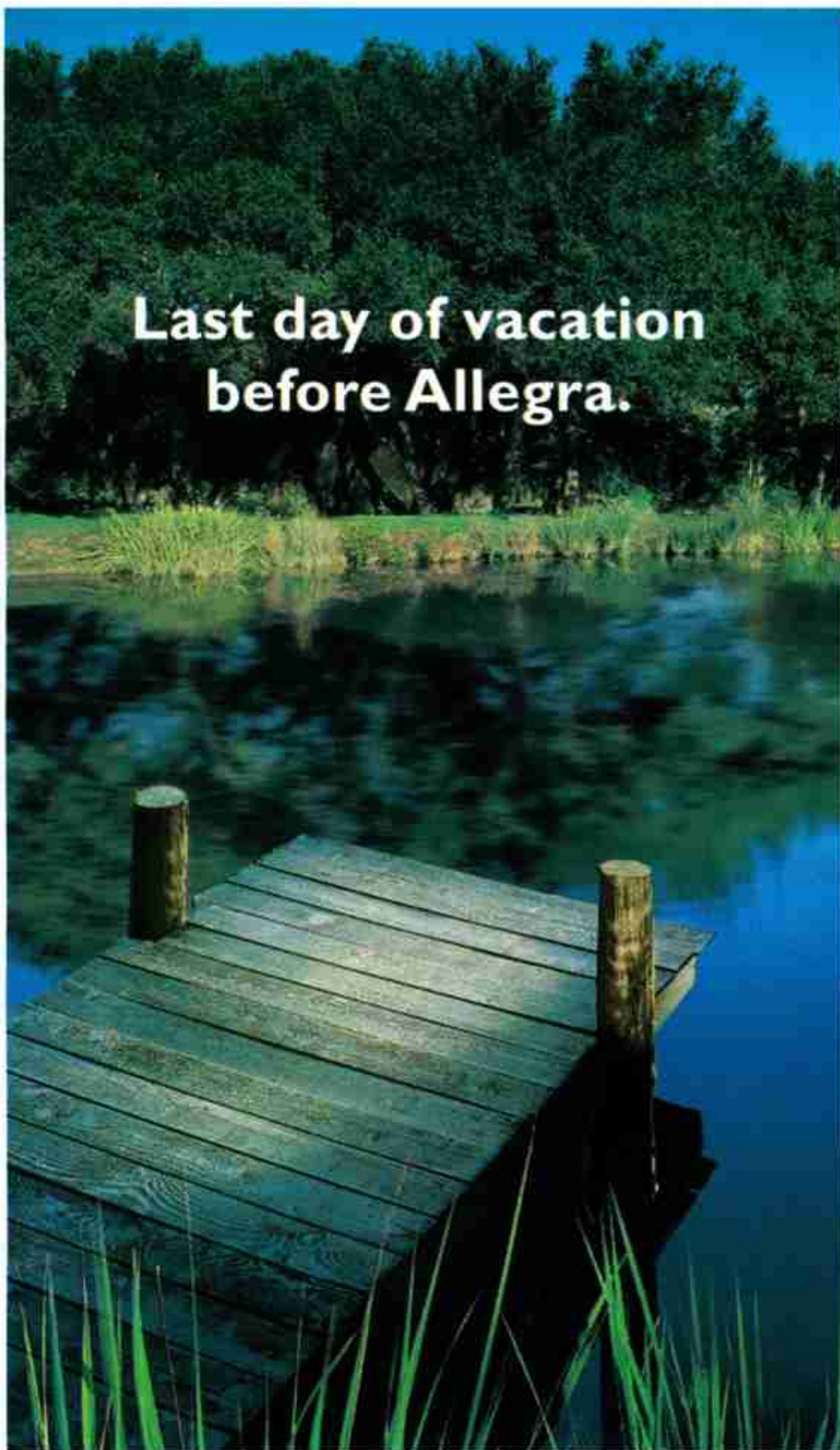
KAYE CRABER
Clarkston, Washington

A mile-wide crater is stark testimony to the power of nature over man. Nature is in charge, and often when we are complacent, she teaches that lesson. Nature reforming and reclaiming with creativity was shown in all its authority and grandeur! Your article and pictures were indefatigable proof of what we Native Americans have always known: Out of fire and ice comes creation.

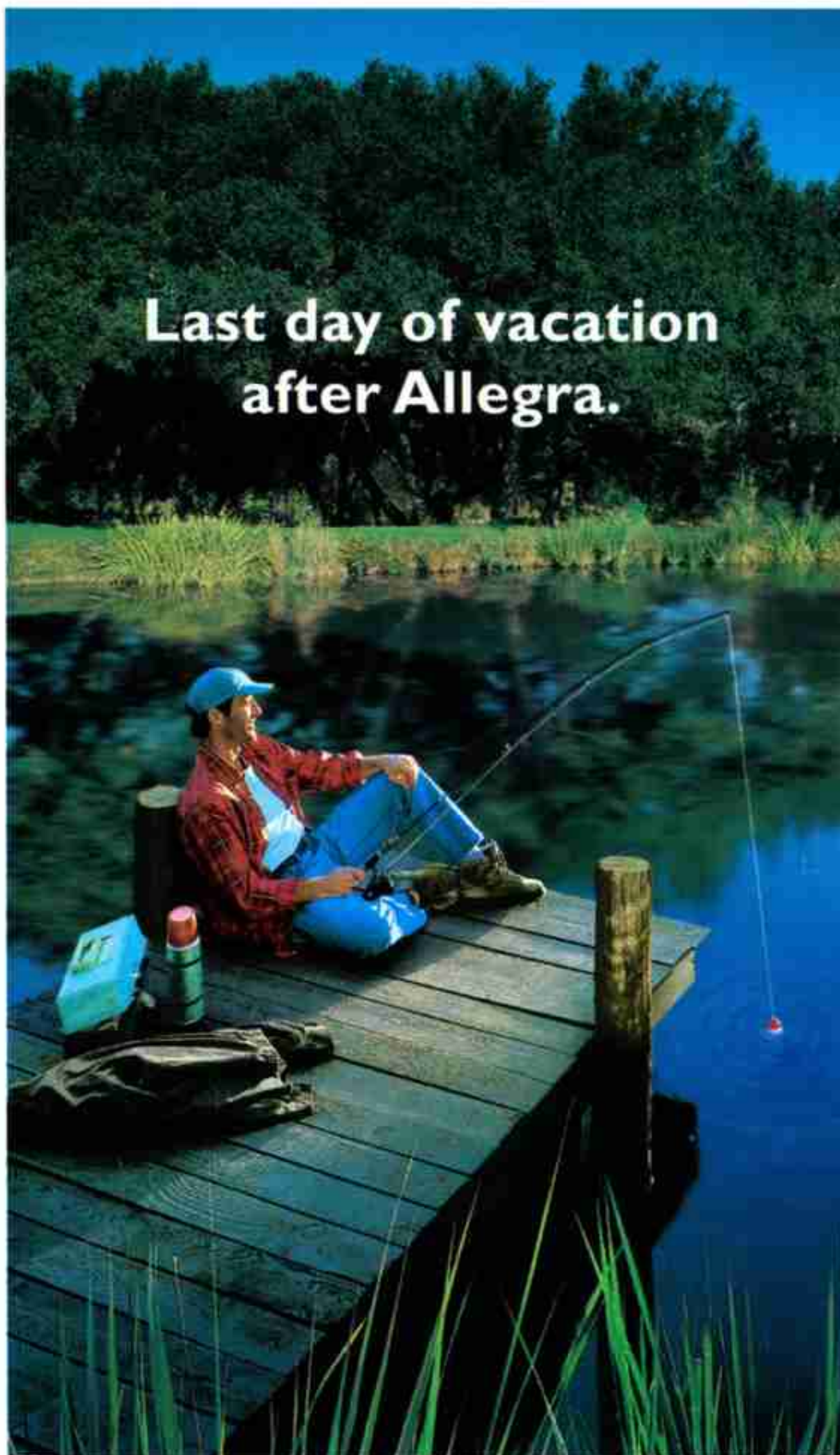
GARY J. SENECA VACHON
Peoria, Illinois

I saw Mount St. Helens 15 years after the 1980 eruption. But despite the photos, the film, the statistics, I had a very difficult time grasping the immensity of just how much of that mountain was blown away. Then in the gift shop of Coldwater Ridge Visitors Center I found a salt and pepper shaker set (of all things) that helped me "get it." Put the two parts together, and you have Mount St. Helens as it looked before the eruption. Take the pepper part off, and you have the after. Looking from shaker to shaker, I thought, "That much. Wow."

LISA THOMSON
Keene, Kentucky



**Last day of vacation
before Allegra.**



**Last day of vacation
after Allegra.**

Only Allegra has fexofenadine for effective nondrowsy relief of your seasonal allergy symptoms. Allegra is for people twelve and older. Ask your doctor or pharmacist for more information. In clinical studies, less than 3% of people experienced drowsiness, cold or flu, nausea, or menstrual pain. Please see additional important information on the next page. 1-800-ALLEGRA www.allegra.com

Enjoy your world.™

nondrowsy
allegra[®]
fexofenadine HCl 60mg capsules

ALLEGRA®
(fexofenadine hydrochloride)
Capsules and Tablets

INDICATIONS AND USAGE

Seasonal Allergic Rhinitis

ALLEGRA is indicated for the relief of symptoms associated with seasonal allergic rhinitis in adults and children 6 years of age and older. Symptoms treated effectively were sneezing, rhinorrhea, itchy nose/palate/throat, itchy/watery/red eyes.

Chronic Idiopathic Urticaria

ALLEGRA is indicated for treatment of uncomplicated skin manifestations of chronic idiopathic urticaria in adults and children 6 years of age and older. It significantly reduces pruritus and the number of wheals.

CONTRAINDICATIONS

ALLEGRA is contraindicated in patients with known hypersensitivity to any of its ingredients.

PRECAUTIONS

Drug Interaction with Erythromycin and Ketoconazole

Fexofenadine hydrochloride has been shown to exhibit minimal (ca. 5%) metabolism. However, co-administration of fexofenadine hydrochloride with ketoconazole and erythromycin led to increased plasma levels of fexofenadine hydrochloride. Fexofenadine hydrochloride had no effect on the pharmacokinetics of erythromycin and ketoconazole. In two separate studies, fexofenadine hydrochloride 120 mg twice daily (two times the recommended twice daily dose) was co-administered with erythromycin 500 mg every 8 hours or ketoconazole 400 mg once daily under steady-state conditions to normal, healthy volunteers (n=24, each study). No differences in adverse events or QT_c interval were observed when patients were administered fexofenadine hydrochloride alone or in combination with erythromycin or ketoconazole. The findings of these studies are summarized in the following table:

Effects on steady-state fexofenadine hydrochloride pharmacokinetics after 7 days of co-administration with fexofenadine hydrochloride 120 mg every 12 hours (two times the recommended twice daily dose) in normal volunteers (n=24)

Concomitant Drug	C _{max} SS (Peak plasma concentration)	AUC _{SS(0-12h)} (Extent of systemic exposure)
Erythromycin (500 mg every 8 hrs)	+82%	+109%
Ketoconazole (400 mg once daily)	+135%	+164%

The changes in plasma levels were within the range of plasma levels achieved in adequate and well-controlled clinical trials.

The mechanism of these interactions has been evaluated *in vitro*, *in situ*, and *in vivo* animal models. These studies indicate that ketoconazole or erythromycin co-administration enhances fexofenadine gastrointestinal absorption. *In vivo* animal studies also suggest that in addition to increasing absorption, ketoconazole decreases fexofenadine hydrochloride gastrointestinal secretion, while erythromycin may also decrease biliary excretion.

Drug Interactions with Antacids

Administration of 120 mg of fexofenadine hydrochloride (2 x 60 mg capsule) within 15 minutes of an aluminum and magnesium containing antacid (Maalox®) decreased fexofenadine AUC by 41% and C_{max} by 43%. ALLEGRA should not be taken closely in time with aluminum and magnesium containing antacids.

Carcinogenesis, Mutagenesis, Impairment of Fertility

The carcinogenic potential and reproductive toxicity of fexofenadine hydrochloride were assessed using terfenadine studies with adequate fexofenadine hydrochloride exposure (based on plasma area-under-the-concentration vs. time [AUC] in rats). No evidence of carcinogenicity was observed in an 18-month study in mice and in a 24-month study in rats at oral doses up to 150 mg/kg of terfenadine (which led to fexofenadine exposures that were respectively approximately 3 and 5 times the exposure from the maximum recommended daily oral dose of fexofenadine hydrochloride in adults and children).

In *in vitro* (Bacterial Reverse Mutation, CHO/HGPRT Forward Mutation, and Rat Lymphocyte Chromosomal Aberration assays) and *in vivo* (Mouse Bone Marrow Micronucleus assay) tests, fexofenadine hydrochloride revealed no evidence of mutagenicity.

In rat fertility studies, dose-related reductions in implants and increases in postimplantation losses were observed at an oral dose of 150 mg/kg of terfenadine (which led to fexofenadine hydrochloride exposures that were approximately 3 times the exposure of the maximum recommended daily oral dose of fexofenadine hydrochloride in adults).

Pregnancy

Teratogenic Effects: Category C. There was no evidence of teratogenicity in rats or rabbits at oral doses of terfenadine up to 300 mg/kg (which led to fexofenadine exposures that were approximately 4 and 31 times, respectively, the exposure from the maximum recommended daily oral dose of fexofenadine in adults).

There are no adequate and well controlled studies in pregnant women. Fexofenadine should be used during pregnancy only if the potential benefit justifies the potential risk to the fetus.

Nonteratogenic Effects. Dose-related decreases in pup weight gain and survival were observed in rats exposed to an oral dose of 150 mg/kg of terfenadine (approximately 3 times the maximum recommended daily oral dose of fexofenadine hydrochloride in adults based on comparison of fexofenadine hydrochloride AUCs).

Nursing Mothers

There are no adequate and well-controlled studies in women during lactation. Because many drugs are excreted in human milk, caution should be exercised when fexofenadine hydrochloride is administered to a nursing woman.

Pediatric Use

The recommended dose in patients 6 to 11 years of age is based on cross-study comparison of the pharmacokinetics of ALLEGRA in adults and pediatric patients and on the safety profile of fexofenadine hydrochloride in both adult and pediatric patients at doses equal to or higher than the recommended doses.

The safety of ALLEGRA tablets at a dose of 30 mg twice daily has been demonstrated in 438 pediatric patients 6 to 11 years of age in two placebo-controlled 2-week seasonal allergic rhinitis trials. The safety of ALLEGRA for the treatment of chronic idiopathic urticaria in patients 6 to 11 years of age is based on cross-study comparison of the pharmacokinetics of ALLEGRA in adult and pediatric patients and on the safety profile of fexofenadine in both adult and pediatric patients at doses equal to or higher than the recommended dose.

The effectiveness of ALLEGRA for the treatment of seasonal allergic rhinitis in patients 6 to 11 years of age was demonstrated in one trial (n=411) in which ALLEGRA tablets 30 mg twice daily significantly reduced total symptom scores compared to placebo, along with extrapolation of demonstrated efficacy in patients ages 12 years and above, and the pharmacokinetic comparisons in adults and children. The effectiveness of ALLEGRA for the treatment of chronic idiopathic urticaria in patients 6 to 11 years of age is based on an extrapolation of the demonstrated efficacy of ALLEGRA in adults with this condition and the likelihood that the disease course, pathophysiology and the drug's effect are substantially similar in children to that of adult patients.

The safety and effectiveness of ALLEGRA in pediatric patients under 6 years of age have not been established.

Geriatric Use

Clinical studies of ALLEGRA tablets and capsules did not include sufficient numbers of subjects aged 65 years and over to determine whether this population responds differently from younger patients. Other reported clinical experience has not identified differences in responses between the geriatric and younger patients. This drug is known to be substantially excreted by the kidney, and the risk of toxic reactions to this drug may be greater in patients with impaired renal function. Because elderly patients are more likely to have decreased renal function, care should be taken in dose selection, and it may be useful to monitor renal function. (See CLINICAL PHARMACOLOGY).

ADVERSE REACTIONS

Seasonal Allergic Rhinitis

Adults. In placebo-controlled seasonal allergic rhinitis clinical trials in patients 12 years of age and older, which included 2461 patients receiving fexofenadine hydrochloride capsules at doses of 120 mg and 240 mg twice daily, adverse events were similar in fexofenadine hydrochloride and placebo-treated patients. All adverse events that were reported by greater than 1% of patients who received the recommended daily dose of fexofenadine hydrochloride (60 mg capsules twice daily), and that were more common with fexofenadine hydrochloride than placebo, are listed in Table 1.

In a placebo-controlled clinical study in the United States, which included 570 patients aged 12 years and older receiving fexofenadine hydrochloride tablets at doses of 120 or 180 mg once daily, adverse events were similar in fexofenadine hydrochloride and placebo-treated patients. Table 1 also lists adverse experiences that were reported by greater than 2% of patients treated with fexofenadine hydrochloride tablets at doses of 180 mg once daily and that were more common with fexofenadine hydrochloride than placebo.

The incidence of adverse events, including drowsiness, was not dose-related and was similar across subgroups defined by age, gender, and race.

Table 1

Adverse experiences in patients ages 12 years and older reported in placebo-controlled seasonal allergic rhinitis clinical trials in the United States

Twice daily dosing with fexofenadine capsules at rates of greater than 1%		
Adverse experience	Fexofenadine 60 mg Twice Daily (n=679)	Placebo Twice Daily (n=671)
Viral Infection (cold, flu)	2.5%	1.5%
Nausea	1.6%	1.5%
Dysmenorrhea	1.5%	0.3%
Drowsiness	1.3%	0.9%
Dyspepsia	1.3%	0.6%
Fatigue	1.3%	0.9%
Once daily dosing with fexofenadine hydrochloride tablets at rates of greater than 2%		
Adverse experience	Fexofenadine 180 mg once daily (n=283)	Placebo (n=293)
Headache	10.6%	7.5%
Upper Respiratory Tract Infection	3.2%	3.1%
Back Pain	2.8%	1.4%

The frequency and magnitude of laboratory abnormalities were similar in fexofenadine hydrochloride and placebo-treated patients.

Pediatric. Table 2 lists adverse experiences in patients aged 6 to 11 years of age which were reported by greater than 2% of patients treated with fexofenadine hydrochloride tablets at a dose of 30 mg twice daily in placebo-controlled seasonal allergic rhinitis studies in the United States and Canada that were more common with fexofenadine hydrochloride than placebo.

Table 2

Adverse experiences reported in placebo-controlled seasonal allergic rhinitis studies in pediatric patients ages 6 to 11 in the United States and Canada at rates of greater than 2%

Adverse experience	Fexofenadine 30 mg twice daily (n=209)	Placebo (n=229)
Headache	7.2%	6.6%
Accidental Injury	2.9%	1.3%
Coughing	3.8%	1.3%
Fever	2.4%	0.9%
Pain	2.4%	0.4%
Otitis Media	2.4%	0.0%
Upper Respiratory Tract Infection	4.3%	1.7%

Chronic Idiopathic Urticaria

Adverse events reported by patients 12 years of age and older in placebo-controlled chronic idiopathic urticaria studies were similar to those reported in placebo-controlled seasonal allergic rhinitis studies. In placebo-controlled chronic idiopathic urticaria clinical trials, which included 726 patients 12 years of age and older receiving fexofenadine hydrochloride tablets at doses of 20 to 240 mg twice daily, adverse events were similar in fexofenadine hydrochloride and placebo-treated patients. Table 3 lists adverse experiences in patients aged 12 years and older which were reported by greater than 2% of patients treated with fexofenadine hydrochloride 60 mg tablets twice daily in controlled clinical studies in the United States and Canada and that were more common with fexofenadine hydrochloride than placebo. The safety of fexofenadine hydrochloride in the treatment of chronic idiopathic urticaria in pediatric patients 6 to 11 years of age is based on the safety profile of fexofenadine hydrochloride in adults and adolescent patients at doses equal to or higher than the recommended dose (see Pediatric Use).

Table 3

Adverse experiences reported in patients 12 years and older in placebo-controlled chronic idiopathic urticaria studies in the United States and Canada at rates of greater than 2%

Adverse experience	Fexofenadine 60 mg twice daily (n=186)	Placebo (n=178)
Back Pain	2.2%	1.1%
Sinusitis	2.2%	1.1%
Dizziness	2.2%	0.6%
Drowsiness	2.2%	0.0%

OVERDOSAGE

Reports of fexofenadine hydrochloride overdose have been infrequent and contain limited information. However, dizziness, drowsiness, and dry mouth have been reported. Single doses of fexofenadine hydrochloride up to 800 mg (six normal volunteers at this dose level), and doses up to 690 mg twice daily for 1 month (three normal volunteers at this dose level) or 240 mg once daily for 1 year (234 normal volunteers at this dose level) were administered without the development of clinically significant adverse events as compared to placebo.

In the event of overdose, consider standard measures to remove any unabsorbed drug. Symptomatic and supportive treatment is recommended.

Hemodialysis did not effectively remove fexofenadine hydrochloride from blood (1.7% removed) following terfenadine administration.

No deaths occurred at oral doses of fexofenadine hydrochloride up to 5000 mg/kg in mice (110 times the maximum recommended daily oral dose in adults and 200 times the maximum recommended daily oral dose in children based on mg/m²) and up to 5000 mg/kg in rats (230 times the maximum recommended daily oral dose in adults and 400 times the maximum recommended daily oral dose in children based on mg/m²). Additionally, no clinical signs of toxicity or gross pathological findings were observed. In dogs, no evidence of toxicity was observed at oral doses up to 2000 mg/kg (300 times the maximum recommended daily oral dose in adults and 530 times the maximum recommended daily oral dose in children based on mg/m²).











Prescribing Information as of February 2000

Aventis Pharmaceuticals Inc.
(formerly Hoechst Marion Roussel, Inc.)
Kansas City, MO 64137 USA

US Patents 4,254,129; 5,375,693; 5,578,610

alib0200g

20012008/1993K0

 My 24k Days. Go >	 Birthday gift and card for my nephew. Earned 1,000 pts.				 5th trip to Canada. Another great Radisson stay. Earned 7,500 pts.
	 Appetizers with Jon at T.G.I. Friday's! Redeemed 1,250 pts.			 Bought flowers for my sweetie on 24k.com. Earned 2,000 pts.	
	 Booked entire NYC vacation on 24k.com. Earned 5,500 pts.				 24k.com suggested guidebook for NYC. Redeemed 3,000 pts.
 Responded to 24k.com offer for golf video. Earned 1,200 pts.				 Reserved room at Country Inns & Suites By Carlson. Earned 2,500 pts.	
 Checked Gold Points balance: on my way to that free cruise!	 Keep going >				

**Experience life.
Experience rewards.**



**Do the things you love.
Reward yourself faster.**

I'll be perfectly honest with you. I love to travel, shop, dine, and experience the most from life. I have a great family and good friends. I have a well-established 401(k). And now I have 24k. That's 24k.com. With 24k.com, it's easy to earn Gold Points for virtually all of my travel, shopping and entertainment experiences. And the best part is I can redeem my points for things like free vacations, meals, and all kinds of name-brand merchandise. And with 100-plus world-class partners—such as **Radisson Hotels & Resorts**, **T.G.I. Friday's**, **SharperImage.com** and **LandsEnd.com**—I have more online and offline earning and redemption options than typical rewards programs. Enroll with 24k.com today. Because if my life is rewarding, yours should be too.

GEOGR

T H E P E O P L E , P L A C E S , A N D

CONSERVATION

An Orchid for the Ages

Giant Asian species unfurls thousands of blooms

High in the Borneo rain forest, biologist Tim Laman came upon a rare sight. Growing 150 feet above the ground, encircling a huge tree trunk, an immense orchid was blooming—*Grammatophyllum speciosum* Blume. It formed a 25-foot-wide “crow’s nest” that had trapped hundreds of pounds of decayed vegetation. From the structure grew some 50 spikes, five to eight feet long. Each spike bore 50 to 100 flowers, here examined by Laman’s climbing partner, Phil Atkinson. The species, first described in 1825 by botanist Carl Blume, grows from mainland Southeast Asia to the Solomon Islands. Only one other orchid species, in Ecuador, approaches it in mass.

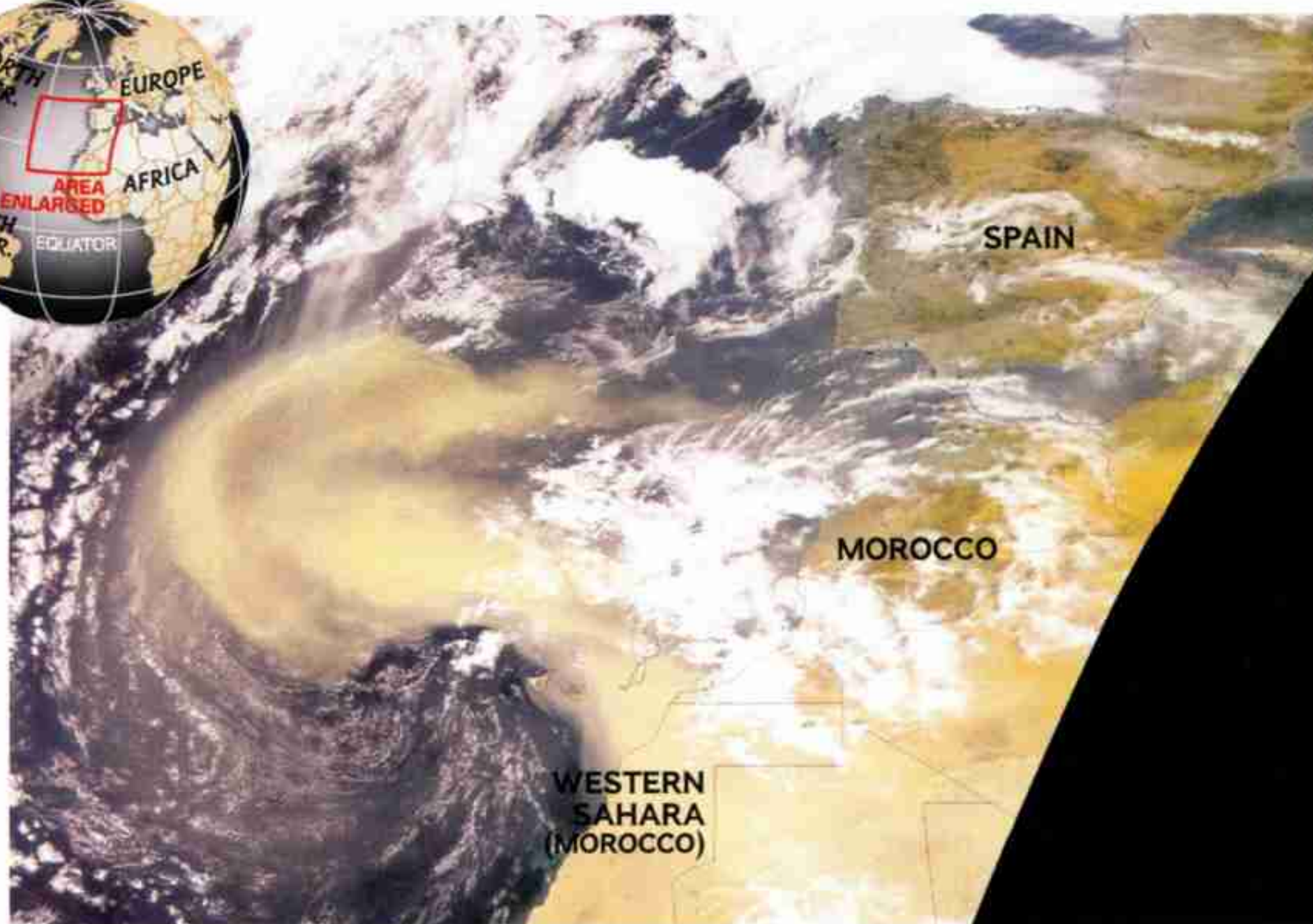
“I think this specimen is a good candidate for the world’s largest single orchid,” says Laman.

CLIMATE

Africa Slowly Blows Away

Disease, nutrients ride airborne soil

Adust storm bigger than Spain raged over the Atlantic a thousand miles off West Africa last February 26. A NASA satellite captured the event (right). Since the early 1970s more and more such storms have been spawned by drought in the Sahel region south of the Sahara. Satellites



SEAWIFS PROJECT, NASA GODDARD SPACE FLIGHT CENTER AND ORBIMAGE

AFRICA

CREATURES OF OUR UNIVERSE



TIM LAMAN

have recorded many of these African tempests, but the size and power of this monster left scientists agog. Riding air currents, one part of the storm blanketed the coast of Portugal and Spain; another part headed west toward the Americas.

Dust storms have long blown over the Atlantic. Aboard H.M.S. *Beagle* near the Cape Verde Islands in 1832, Charles Darwin recognized one storm's origin. "The dust falls in such quantities as to dirty everything on board," he wrote. "We may feel sure that it all comes from Africa."

Today an army of researchers study the storms and their fallout. Many roll off Africa during

summer, and several scientists are investigating whether they affect hurricane formation.

Much of the dust crossing the Atlantic falls in the southeast U.S., some as far west as New Mexico. A major depot is the Caribbean, where about a billion tons a year is dumped. There, some biologists believe, the dust causes stress and disease among coral reefs. Garriet Smith of the University of South Carolina has detected in the dust a fungus, *Aspergillus*, that kills soft corals such as sea fans. Yet when the same earthy essence of Africa drifts into South America, the phosphate it carries fertilizes the Amazon's nutrient-poor soil.

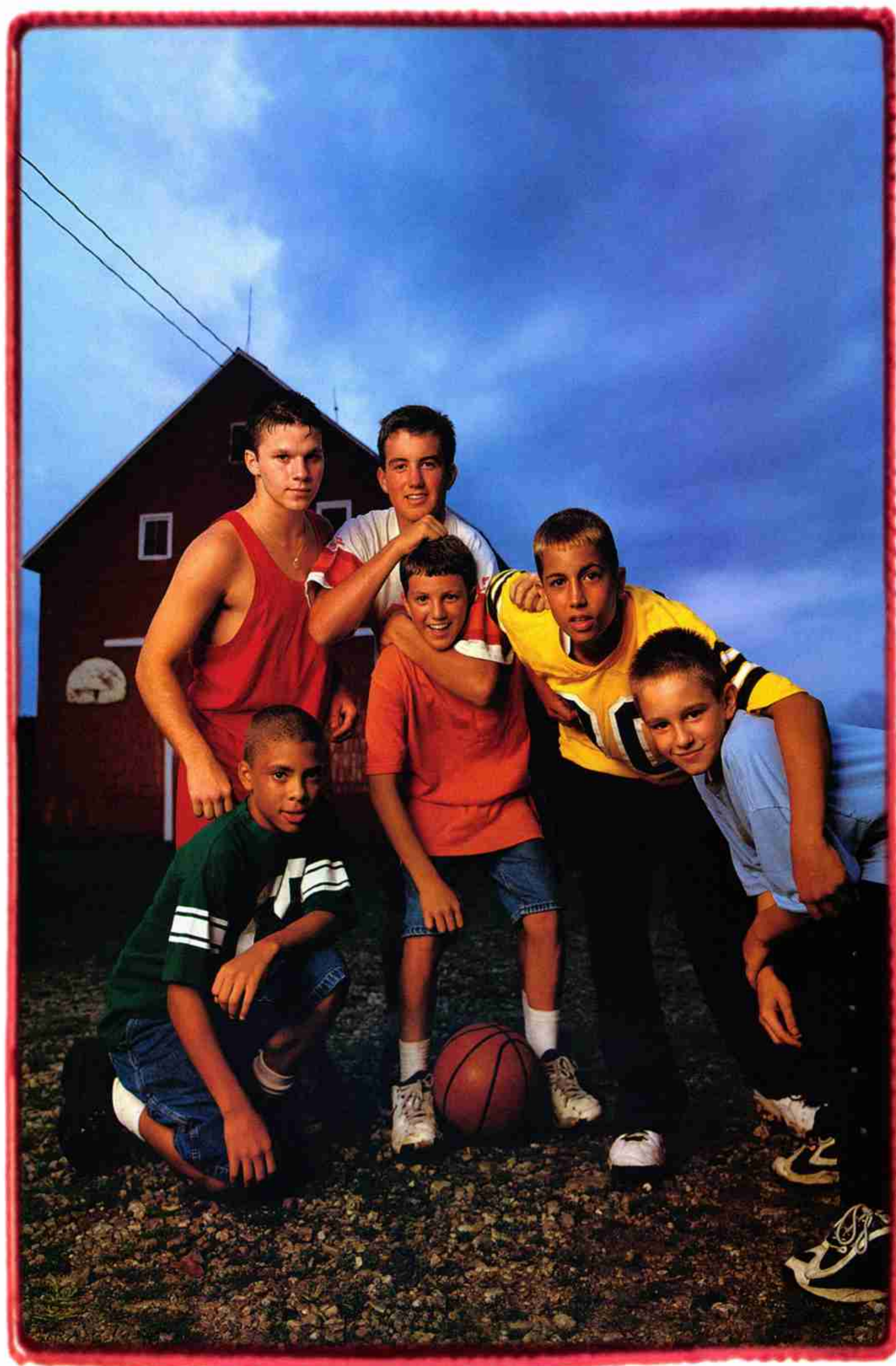
ALMANAC

September

As summer wanes, lavender spokes of Michaelmas daisies rise from English gardens and roadsides. *Aster novi-belgii*'s roots are American, and the green-thumbed English have embraced it since its arrival from New York in 1710. They named it after St. Michael, whose feast falls on September 29—around the peak of the plant's blooming period.



ART BY MATT FREY



I N D I A N A

T E A M

S P I R I T

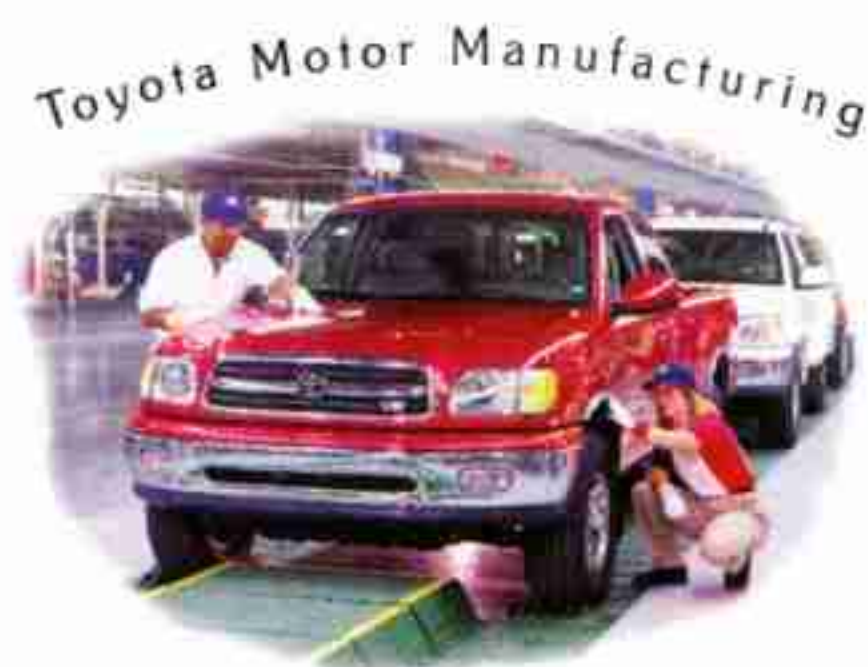
It's building

M O R E T H A N J U S T

G R E A T

A T H L E T E S

Indiana has been home to some of America's greatest sports teams for more than a century. Maybe it's because Hoosiers are naturally competitive. Or maybe it's because the local fans are so supportive. Whatever the reason,



Indiana, USA

teamwork is one of the qualities that has made their state great. And it's definitely one of the reasons Indiana was chosen as the site of Toyota's major new U.S. vehicle manufacturing plant.

By the time it's fully operational, Toyota Motor Manufacturing, Indiana will have the capacity to produce 300,000 vehicles per year. The 4,300 jobs created here will raise Toyota's direct U.S. employment to more than 29,000. Now that's what we call an expansion team.

As a company doing business in the global marketplace, Toyota recognizes the need to invest in local design, research and manufacturing, to ensure that the products we sell answer the special needs and standards of all of our drivers. That's why, in 26 countries around the world, Toyota vehicles are manufactured by the same people who drive them – local people.

Sure, it makes good business sense for Toyota. But it also builds growth and competitiveness in the communities where we do business. That's what team spirit means to Toyota. It's how we play the game.

TOYOTA People Drive Us



PETER MACDIARMID, THE INDEPENDENT, LONDON

TECHNOLOGY

A Dog's Life Improves

For a century the United Kingdom imposed a six-month quarantine on all pets entering the country. Now some, like Frodo Baggins (above), who sailed on a ferry from Calais, France, to Dover, can immediately clear British customs if

a pet passport issued by a vet declares them rabies free. In the pilot program dogs and cats arriving on specified routes from 22 European nations can get rabies shots abroad. A microchip embedded by the vet confirms identity. The passport must also show the pet clear of ticks and tapeworms within 48 hours of entry. In the first month the owners of around 600 pets paid for the \$450 procedure.



JOEL SARTORE

CONSERVATION

Whale of a Victory in Mexico

Decision to forgo salt plant leaves lagoon pristine

A five-year-long heavy-weight bout in Baja California between whale defenders and commercial developers ended last March with a technical knockout. Japan's Mitsubishi Corporation and the Mexican government cancelled plans to build a salt-evaporation

plant on the shoreline of Laguna San Ignacio.

Each winter, gray whales migrate to the lagoon to give birth and mate. Environmentalists charged that the whales would be put at risk by the plant, which would have covered more than a hundred square miles and

poured concentrated salt brine into the lagoon.

Mexican President Ernesto Zedillo denied the whales would be harmed. He said the plant was scrapped to protect the land around the lagoon. A World Heritage site, the lagoon draws 3,000 whale-watchers each year.

TAKE FIVE

States With the Most Hurricanes (1899-1999)

1. Florida (60)
2. Texas (37)
3. North Carolina (29)
4. Louisiana (26)
5. South Carolina (15)

Most Expensive Hurricanes (property damage in 1996 dollars)

1. Andrew (1992) \$30.5 billion
2. Hugo (1989) \$8.5 billion
3. Agnes (1972) \$7.5 billion
4. Betsy (1965) \$7.4 billion
5. Camille (1969) \$6.1 billion

SOURCE: THE NATIONAL HURRICANE CENTER, MIAMI

A lot of guys have occasional erection problems.



- VIAGRA has shown improvement in erectile function in 4 out of 5 men compared with 1 out of 4 for sugar tablets
- More than 17 million prescriptions written in the United States*
- Effective and well tolerated in a variety of patients
- More than 6 million men in the US have been prescribed VIAGRA (1 million were also taking blood pressure-lowering medication)

I chose not to accept mine
and asked about VIAGRA.

VIAGRA is not for everyone. Be sure to ask your doctor if your heart is healthy enough to handle the extra strain of sexual activity. If you have chest pains, dizziness, or nausea during sex, stop and immediately tell your doctor.

If you're a man who uses nitrate drugs, never take VIAGRA—your blood pressure could suddenly drop to an unsafe level. With VIAGRA, the most common side effects are headache, facial flushing, and upset stomach. VIAGRA may also briefly cause bluish vision, sensitivity to light, or blurred vision. In the rare event of an erection lasting more than 4 hours, seek immediate medical help. Remember to protect yourself and your partner from sexually transmitted diseases.

Please see patient summary of information about VIAGRA (25-mg, 50-mg, 100-mg) tablets on the following page.

*Data on file. Pfizer Inc., New York, NY.

Ask your doctor if a FREE TRIAL of VIAGRA is right for you.
For more information, call 1-888-4VIAGRA or visit www.viagra.com.

VIAGRA[®]
(sildenafil citrate) tablets
Love life again.



PATIENT SUMMARY OF INFORMATION ABOUT

VIAGRA®
(sildenafil citrate) tablets

This summary contains important information about VIAGRA®. It is not meant to take the place of your doctor's instructions. Read this information carefully before you start taking VIAGRA. Ask your doctor or pharmacist if you do not understand any of this information or if you want to know more about VIAGRA.

This medicine can help many men when it is used as prescribed by their doctors. However, VIAGRA is not for everyone. It is intended for use only by men who have a condition called erectile dysfunction. **VIAGRA must never be used by men who are taking medicines that contain nitrates of any kind, at any time. This includes nitroglycerin. If you take VIAGRA with any nitrate medicine your blood pressure could suddenly drop to an unsafe or life threatening level.**

What Is VIAGRA?

VIAGRA is a pill used to treat erectile dysfunction (impotence) in men. It can help many men who have erectile dysfunction get and keep an erection when they become sexually excited (stimulated).

You will not get an erection just by taking this medicine. VIAGRA helps a man with erectile dysfunction get an erection only when he is sexually excited.

How Sex Affects the Body

When a man is sexually excited, the penis rapidly fills with more blood than usual. The penis then expands and hardens. This is called an erection. After the man is done having sex, this extra blood flows out of the penis back into the body. The erection goes away. If an erection lasts for a long time (more than 6 hours), it can permanently damage your penis. You should call a doctor immediately if you ever have a prolonged erection that lasts more than 4 hours.

Some conditions and medicines interfere with this natural erection process. The penis cannot fill with enough blood. The man cannot have an erection. This is called erectile dysfunction if it becomes a frequent problem.

During sex, your heart works harder. Therefore sexual activity may not be advisable for people who have heart problems. Before you start any treatment for erectile dysfunction, ask your doctor if your heart is healthy enough to handle the extra strain of having sex. If you have chest pains, dizziness or nausea during sex, stop having sex and immediately tell your doctor you have had this problem.

How VIAGRA Works

VIAGRA enables many men with erectile dysfunction to respond to sexual stimulation. When a man is sexually excited, VIAGRA helps the penis fill with enough blood to cause an erection. After sex is over, the erection goes away.

VIAGRA Is Not for Everyone

As noted above (*How Sex Affects the Body*), ask your doctor if your heart is healthy enough for sexual activity.

If you take any medicines that contain nitrates—either regularly or as needed—you should never take VIAGRA. If you take VIAGRA with any nitrate medicine or recreational drug containing nitrates, your blood pressure could suddenly drop to an unsafe level. You could get dizzy, faint, or even have a heart attack or stroke. Nitrates are found in many prescription medicines that are used to treat angina (chest pain due to heart disease) such as:

- nitroglycerin (sprays, ointments, skin patches or pastes, and tablets that are swallowed or dissolved in the mouth)
- isosorbide mononitrate and isosorbide dinitrate (tablets that are swallowed, chewed, or dissolved in the mouth)

Nitrates are also found in recreational drugs such as amyl nitrate or nitrite ("poppers"). If you are not sure if any of your medicines contain nitrates, or if you do not understand what nitrates are, ask your doctor or pharmacist.

VIAGRA is only for patients with erectile dysfunction. VIAGRA is not for newborns, children, or women. Do not let anyone else take your VIAGRA. VIAGRA must be used only under a doctor's supervision.

What VIAGRA Does Not Do

- VIAGRA does not cure erectile dysfunction. It is a treatment for erectile dysfunction.
- VIAGRA does not protect you or your partner from getting sexually transmitted diseases, including HIV—the virus that causes AIDS.
- VIAGRA is not a hormone or an aphrodisiac.

What To Tell Your Doctor Before You Begin VIAGRA

Only your doctor can decide if VIAGRA is right for you. VIAGRA can cause mild, temporary lowering of your blood pressure. You will need to have a thorough medical exam to diagnose your erectile dysfunction and to find out if you can safely take VIAGRA alone or with your other medicines. Your doctor should determine if your heart is healthy enough to handle the extra strain of having sex.

Be sure to tell your doctor if you:

- have ever had any heart problems (e.g., angina, chest pain, heart failure, irregular heart beats, or heart attack)
- have ever had a stroke
- have low or high blood pressure

- have a rare inherited eye disease called retinitis pigmentosa
- have ever had any kidney problems
- have ever had any liver problems
- have ever had any blood problems, including sickle cell anemia or leukemia
- are allergic to sildenafil or any of the other ingredients of VIAGRA tablets
- have a deformed penis, Peyronie's disease, or ever had an erection that lasted more than 4 hours
- have stomach ulcers or any types of bleeding problems
- are taking any other medicines

VIAGRA and Other Medicines

Some medicines can change the way VIAGRA works. Tell your doctor about **any medicines** you are taking. Do not start or stop taking any medicines before checking with your doctor or pharmacist. This includes prescription and nonprescription medicines or remedies. Remember, VIAGRA should never be used with medicines that contain nitrates (see *VIAGRA Is Not for Everyone*). If you are taking a protease inhibitor, your dose may be adjusted (please see *Finding the Right Dose for You*.) VIAGRA should not be used with any other medical treatments that cause erections. These treatments include pills, medicines that are injected or inserted into the penis, implants or vacuum pumps.

Finding the Right Dose for You

VIAGRA comes in different doses (25 mg, 50 mg and 100 mg). If you do not get the results you expect, talk with your doctor. You and your doctor can determine the dose that works best for you.

- Do not take more VIAGRA than your doctor prescribes.
- If you think you need a larger dose of VIAGRA, check with your doctor.
- VIAGRA should not be taken more than once a day.

If you are older than age 65, or have serious liver or kidney problems, your doctor may start you at the lowest dose (25 mg) of VIAGRA. If you are taking protease inhibitors, such as for the treatment of HIV, your doctor may recommend a 25 mg dose and may limit you to a maximum single dose of 25 mg of VIAGRA in a 48 hour period.

How To Take VIAGRA

Take VIAGRA about one hour before you plan to have sex. Beginning in about 30 minutes and for up to 4 hours, VIAGRA can help you get an erection if you are sexually excited. If you take VIAGRA after a high-fat meal (such as a cheeseburger and french fries), the medicine may take a little longer to start working. VIAGRA can help you get an erection when you are sexually excited. You will not get an erection just by taking the pill.

Possible Side Effects

Like all medicines, VIAGRA can cause some side effects. These effects are usually mild to moderate and usually don't last longer than a few hours. Some of these side effects are more likely to occur with higher doses. The most common side effects of VIAGRA are headache, flushing of the face, and upset stomach. Less common side effects that may occur are temporary changes in color vision (such as trouble telling the difference between blue and green objects or having a blue color tinge to them), eyes being more sensitive to light, or blurred vision.

In rare instances, men have reported an erection that lasts many hours. You should call a doctor immediately if you ever have an erection that lasts more than 4 hours. If not treated right away, permanent damage to your penis could occur (see *How Sex Affects the Body*).

Heart attack, stroke, irregular heart beats, and death have been reported rarely in men taking VIAGRA. Most, but not all, of these men had heart problems before taking this medicine. It is not possible to determine whether these events were directly related to VIAGRA.

VIAGRA may cause other side effects besides those listed on this sheet. If you want more information or develop any side effects or symptoms you are concerned about, call your doctor.

Accidental Overdose

In case of accidental overdose, call your doctor right away.

Storing VIAGRA

Keep VIAGRA out of the reach of children. Keep VIAGRA in its original container. Store at room temperature, 59°-86°F (15°-30°C).

For More Information on VIAGRA

VIAGRA is a prescription medicine used to treat erectile dysfunction. Only your doctor can decide if it is right for you. This sheet is only a summary. If you have any questions or want more information about VIAGRA, talk with your doctor or pharmacist, visit www.viagra.com, or call 1-888-4VIAGRA.

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CARTOGRAPHY

Realigning the Football Stars



Pity the geographically challenged National Football League: a National Football Conference (NFC) with Atlanta's Falcons in its West Division and the Arizona Cardinals in the East, an American Football Conference (AFC) with the Jacksonville Jaguars in the Central Division and the Indianapolis Colts in the East. But a chance to correct such oddities looms just over the horizon. Team owners will vote by next spring on a new alignment of divisions before a Houston team joins the league in 2002. NATIONAL GEOGRAPHIC offers this proposal on how to bring the NFL to its geographic senses.



NG MAPS; ART BY MATT FREY

U.S. HISTORY

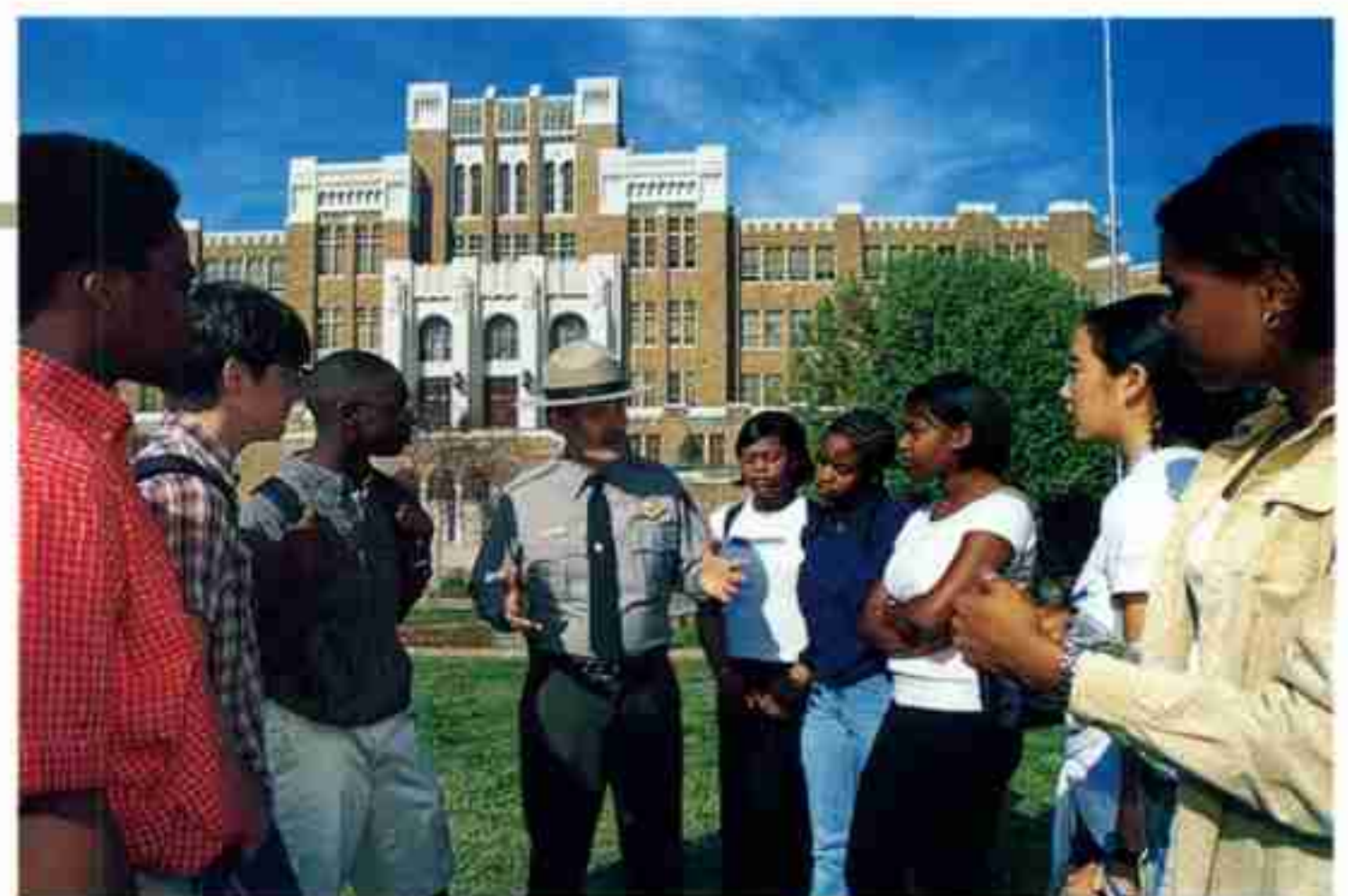
Hallowed Site, Working School

In fall 1957 the world's eyes focused upon Central High School in Little Rock, Arkansas, as nine African-American students set out to integrate the all-white school (below). Governor Orval Faubus ordered the Arkansas National Guard to keep them out. Three weeks later he withdrew the guard, allowing the black students to enter but leaving them to face a hostile mob of townspeople.



WILL COUNTS

President Dwight D. Eisenhower responded by calling out troops, and the Little Rock Nine finished



MATT BRADLEY

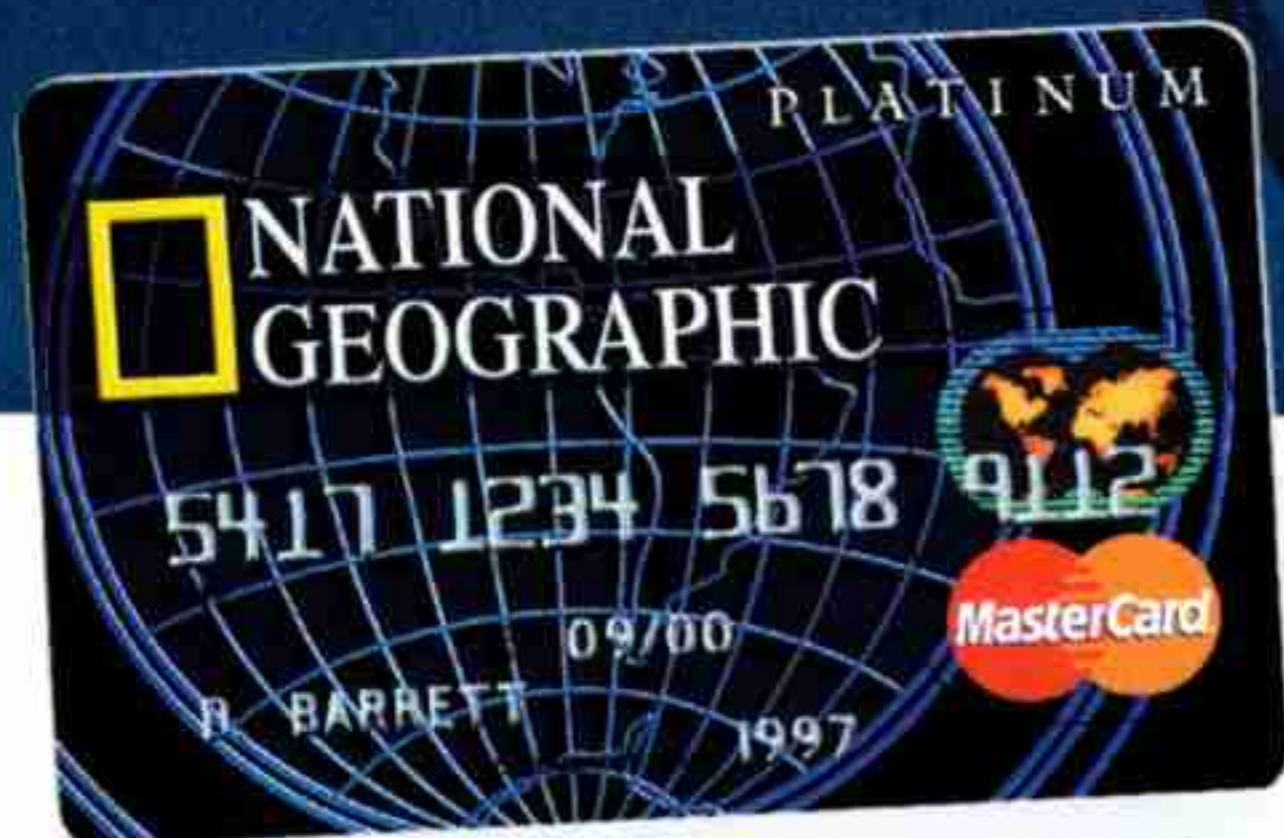
the academic year under federal protection.

President Clinton, a native Arkansan, has called Central High "a hallowed place." Now, though still a public school, it is also a newly minted national historic site, with the National Park Service leading small tours (above). The agency is studying how to tell the Central High story to greater numbers of visitors without interfering with the school's operation and is developing a full interpretive program.

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Photo By: David Doubilet

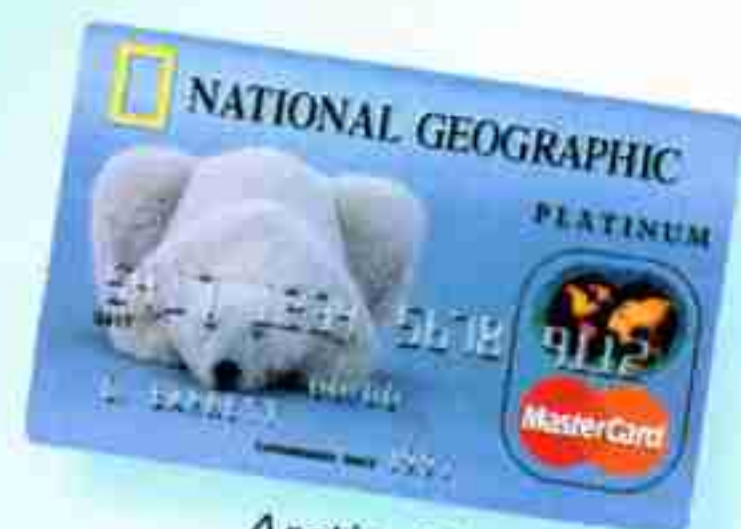
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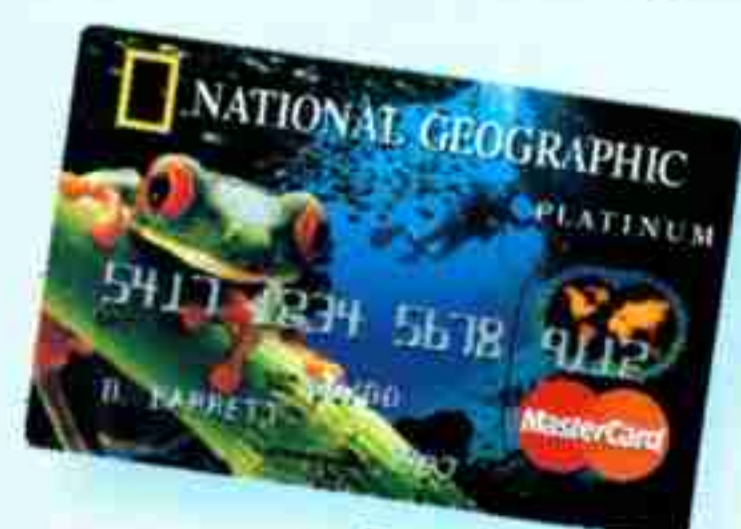
Arctic After Hours



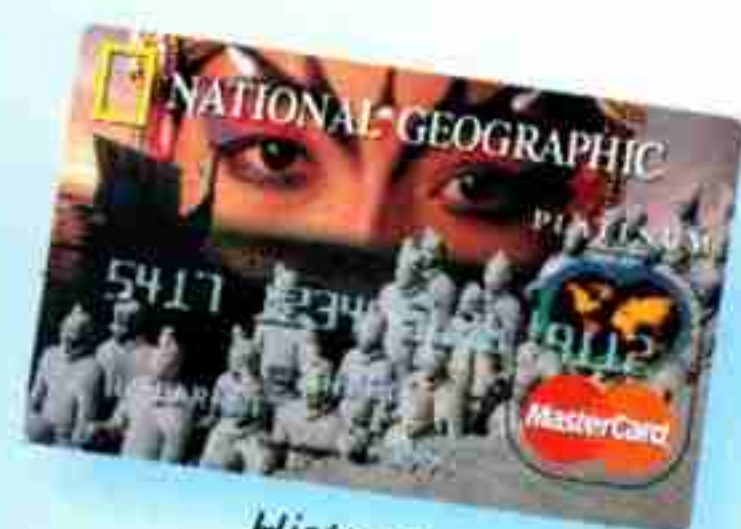
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DARLYNE A. MURAWSKI

INSECT WORLD

Deadly Fungi Take to the Trees

The genus *Cordyceps* includes fungus species that fatally invade the bodies of ants and other insects. In Costa Rica *Cordyceps unilateralis* killed this arboreal carpenter ant.

The fungus then grew from its body like triumphant antlers. From “knots” on the antlers the fungus will shoot off new spores to be dispersed by the breeze.

Normally dead carpenter ants fall to the forest floor, but fungus-infected ants often clamp down on a leaf as they die, placing the fungus where it can claim other tree-dwelling victims.

NATURE

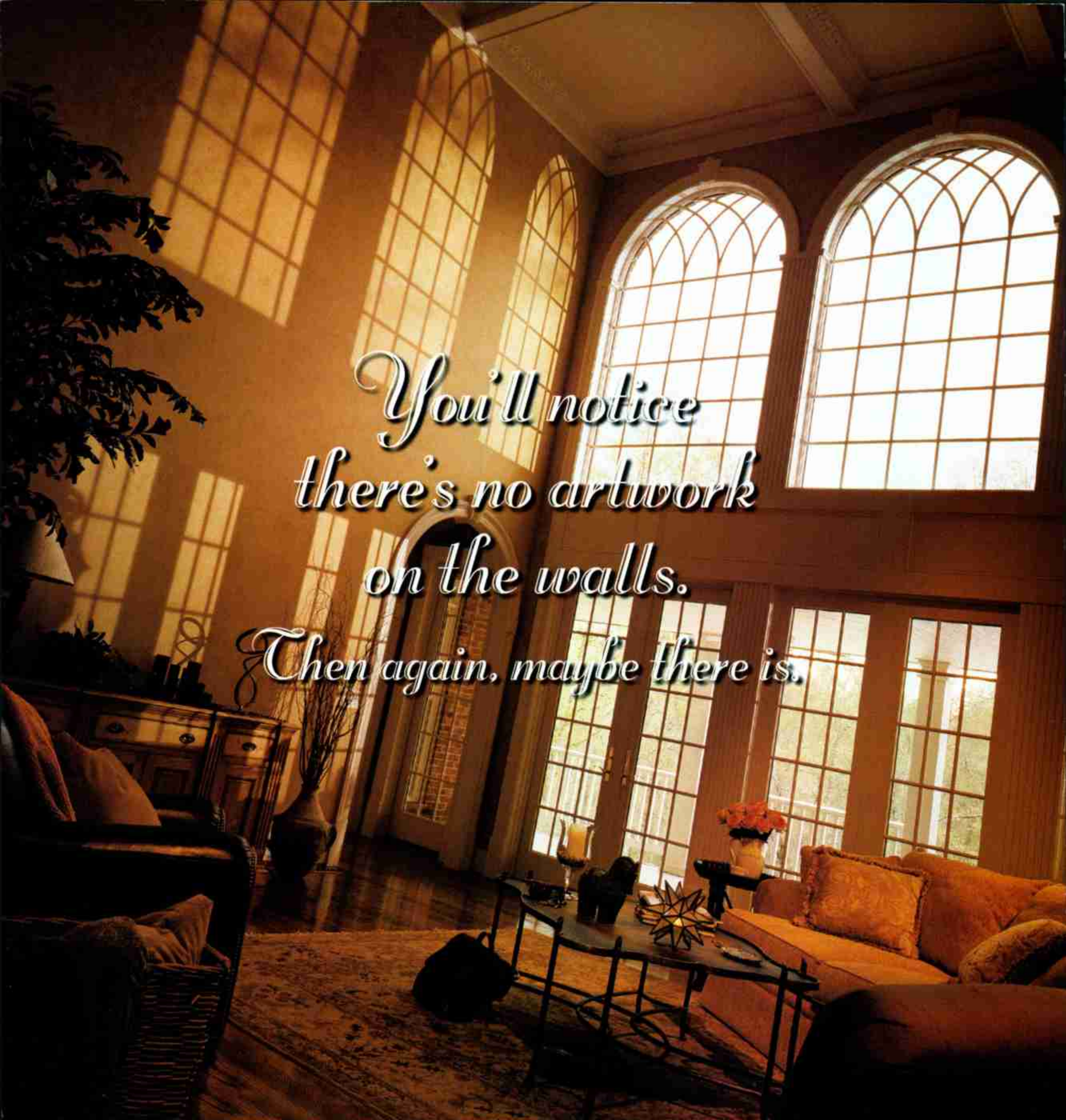
An Elite Group of Tiny Lemurs

Uniquely evolved primates, Madagascar's 25 or so lemur species include the four known mouse lemurs, which weigh less than a chicken egg. This 1.4-ounce brown mouse lemur from the east coast rain forests reigned as the world's smallest primate when first studied by Northwestern University biologist Sylvia Atsalis. But now the pygmy mouse lemur—weighing just an ounce—has claimed

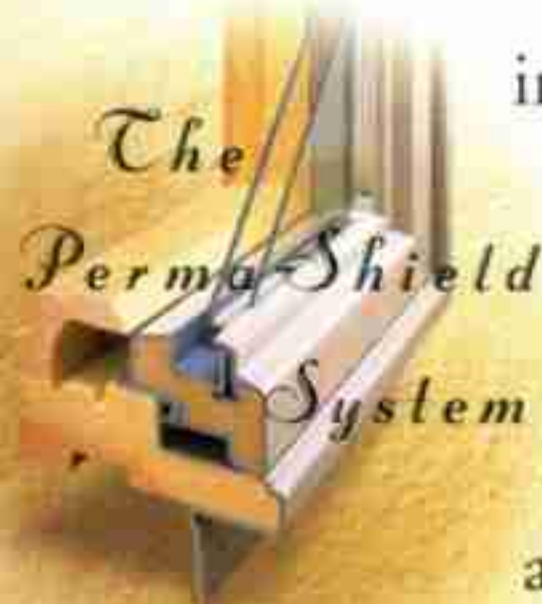
the title. The two bigger mouse lemurs—the gray and the northwestern golden brown—might outweigh a medium egg, but not an extra large.



SYLVIA ATSALIS



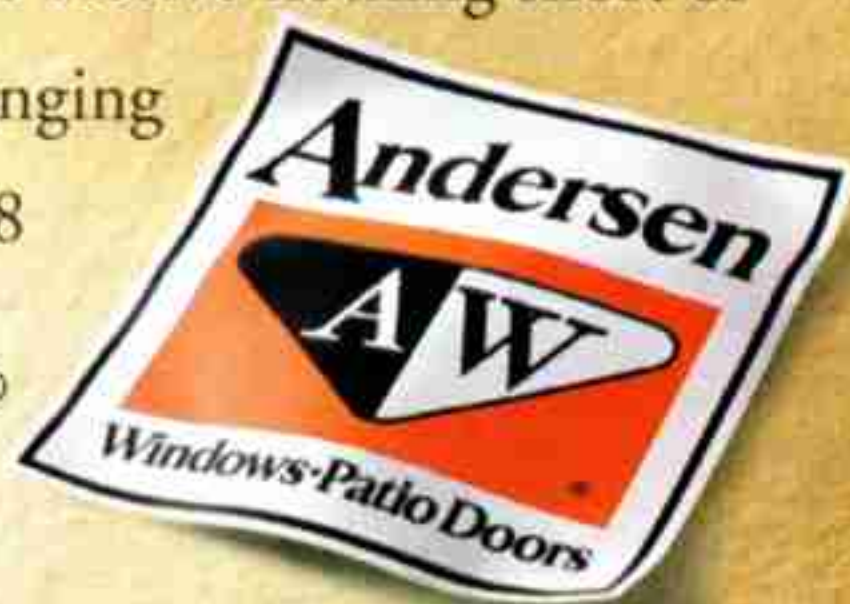
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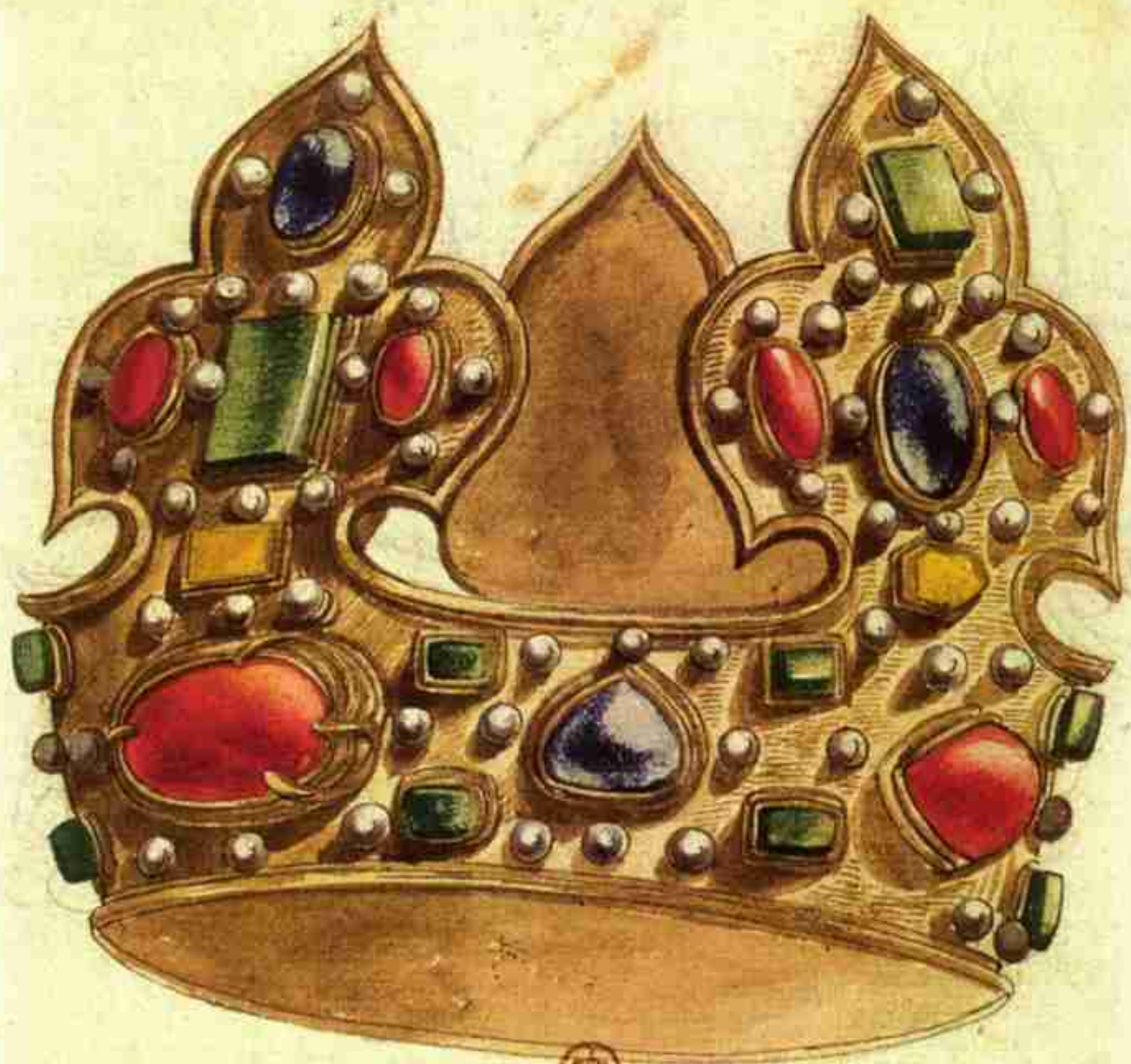
UPDATE

Gem of a Discovery

The source of emeralds is set in stone

In the murky world of emeralds (GEOGRAPHIC, July 1990) heated debate rages over the origin of some of history's most famous jewels. Are there, as legends say, really "old mine" emeralds, dazzling stones from India that were sold in the 16th and 17th centuries by Mogul traders?

The discovery that every emerald has a "fingerprint"—an oxygen isotope composition virtually unique to its source—has allowed French scientists to determine where several famous stones were mined. They analyzed nine emeralds, from a Gallo-Roman earring of the third century A.D. to this 51.5-carat gem (above) from



S^t Louis
 Couronne Du Roy Charlemagne Tirée sur celle qui est en L'Abbaie de Saint Denis en France.

NATIONAL MUSEUM OF NATURAL HISTORY, PARIS (LEFT); NATIONAL LIBRARY, PARIS

the Holy Crown of France (top), worn by Louis IX in 1226. The earring's emerald came from Pakistan, suggesting the Romans traded farther afield than

previously thought. The French crown jewel originated in Austria, a major source of emeralds before the Spanish found Colombia's mines in 1545. None of the nine gems was from India.

MARINE BIOLOGY

Shrinking Iguanas

Once land dwellers, marine iguanas in the Galápagos shifted to sea life millions of years ago. Now researchers Martin Wikelski and Corinna Thom have found that iguanas can adapt to El Niño. That climatic event raises Galápagos water temperatures high enough to kill marine algae, the lizards' food. During the famine the length of the iguanas' bodies shrinks as much as 20 percent, much of that probably bone loss. They grow back to normal when the algae return after El Niño subsides.



DAVID DOUBILET

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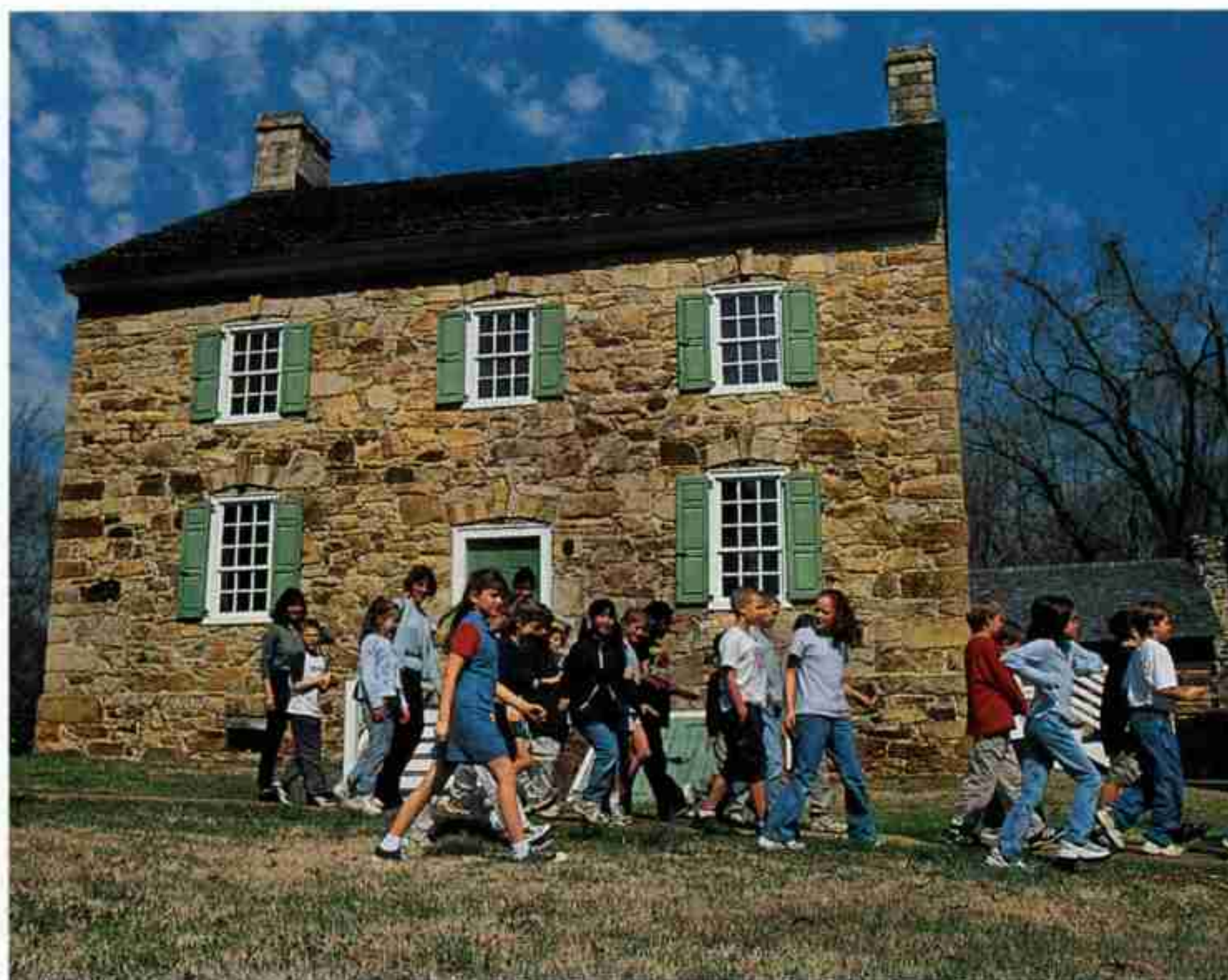


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ALL BY JON O. HOLLOWAY

U.S. HISTORY

“Reading” the Walls

When North Carolina civic leader Hezekiah Alexander’s stone house was completed in 1774, its front wall displayed a series of mysterious inscriptions. Now an interpretation of them suggests that the house, part of the Charlotte Museum of History, was used as a Masonic meeting place.

Modern Freemasonry, a fraternal society, originated in the 18th century. Walter J. Klein, a Mason and museum board member, believes the Alexander house markings show that Masonic functions were held there. Not all Masonic scholars agree with Klein’s reading of the symbols. He interprets a reversed S (far left) as a rope used to guide Masonic candidates during initiation rituals, three dots within a heart as “the three great lights of Masonry,” and a rectangle with three lines as symbolic of a Masonic Master’s hat.



ARCHAEOLOGY

A Ride Into Eternity

Laid to rest in style around 300 B.C., two Celts of high standing were buried in France with weapons, prized possessions—and chariots. French archaeologists probing an area slated for runway expansion at Paris’s Charles de Gaulle Airport found their elaborate tombs. One, a warrior, lay atop a war chariot with pieces of harness on his chest. The other lay on a ceremonial chariot near fine decorative bronze items like this container lid (right). “The size and quality of their rich funerary ensembles show that these people came from a social elite,” says Thierry Lejars, the dig’s leader.



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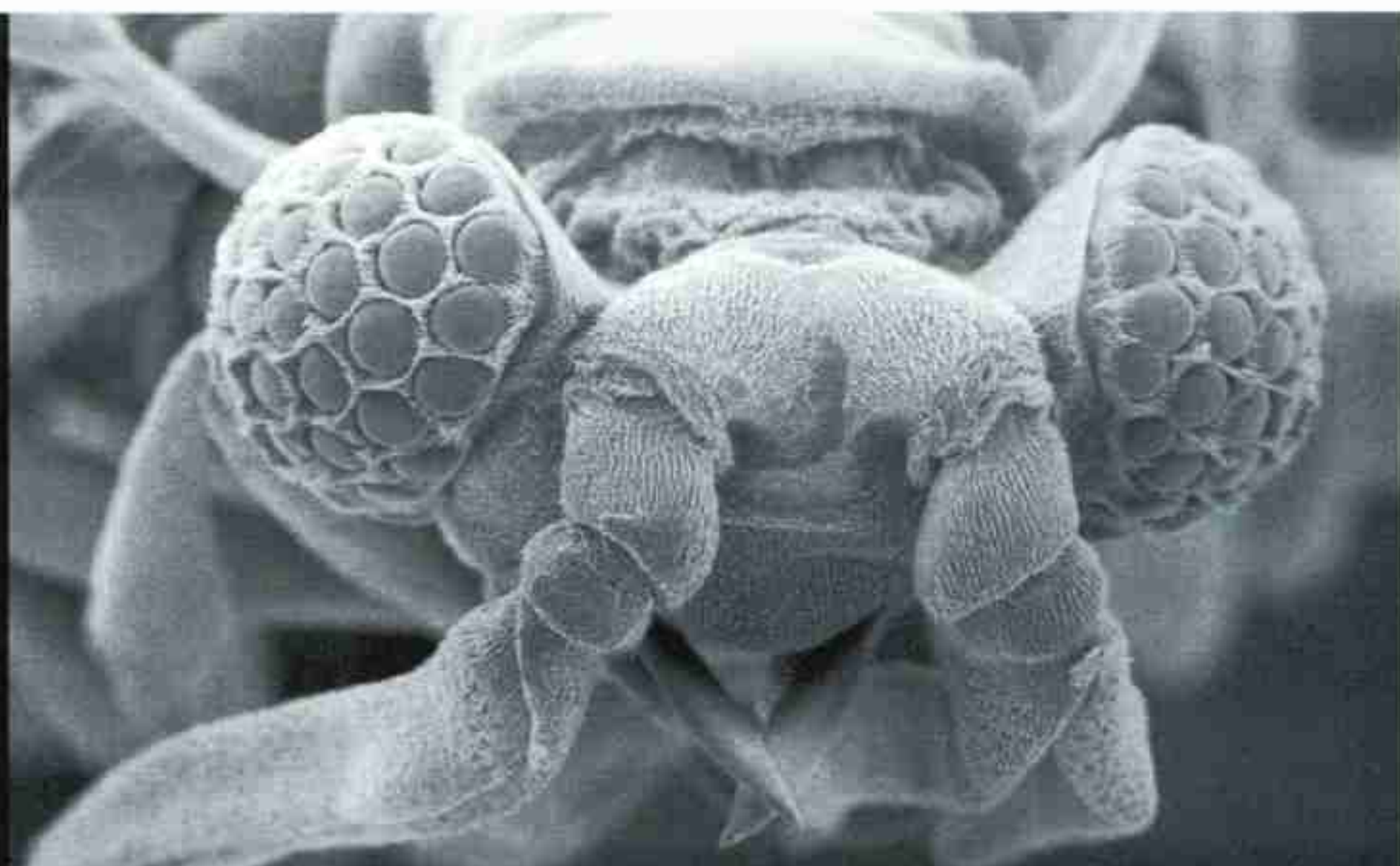
Insects With Unique Vision

Mating males zero in

Tiny parasites called *Xenos peckii* live inside wasps' abdomens.

Females never leave and thus have no need for eyes. Males have unusual eyes, probably to locate females living in other wasps, researchers Elke Buschbeck, Birgit Ehmer, and Ron Hoy of Cornell University found.

"Males live for only a few hours," says Ehmer. "We think



ELKE BUSCHBECK AND BIRGIT EHMER

the male first follows a scent the female emits, then uses its eyes to close in." Most insects of similar size have eyes with thousands of lenses that each see a tiny point. The eyes of *X. peckii* have only about 50

lenses, though much larger than average, each with its own retina. They gather more light and see a bigger area. The eyes resemble those of trilobites, marine arthropods extinct for 250 million years.



NGS PHOTOGRAPHER JODI COBB

GLOBALIZATION

A London Landmark

A bit of South Asia—a large bit—in northwest London, the Shree Swaminarayan Mandir complex

grabs the eye and a place in the record books: At 70 feet high, 75 feet wide, and 195 feet long, it is the largest Hindu temple outside India. Built with 5,000 tons of Bulgarian limestone and Carrara marble on the site of a former truck-servicing center, the

temple features intricate carvings created in India. Since it opened in 1995, the temple has been a spiritual home to southeastern England's 280,000 Hindus, testimony to the sizable Indian migration to the seat of their nation's former colonial rulers.



Photographed by George B. Schaller

WILDLIFE AS CANON SEES IT

A herd of chiru, or Tibetan antelope, roams over desolate snow-covered plains. With the onset of spring, most chirus migrate north. Males disperse to forage on herbs and grasses during a scant three-month growing season, while females trek to calving grounds. After giving birth, the females return south with their young, but nearly half the newborns perish on the way. Chirus that survive the harsh environment continue to face heavy odds—poachers hunt them relentlessly for their fine wool, known as “shahtoosh.” Increased worldwide demand

for shahtoosh scarves and shawls is pushing the species toward extinction.

As a global corporation committed to social and environmental concerns, we join in worldwide efforts to promote greater awareness of endangered species for the benefit of future generations.



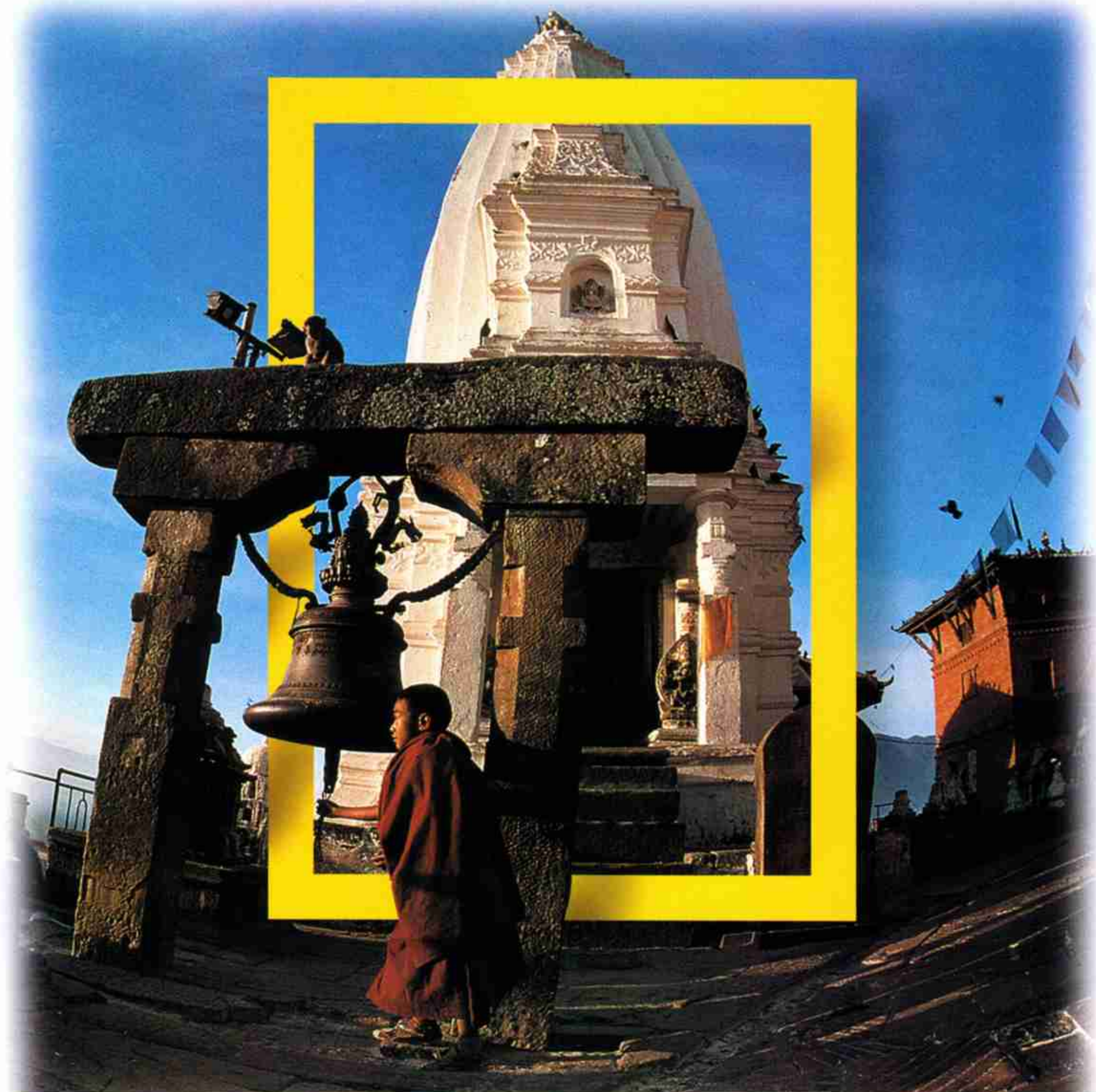
Chiru (*Pantholops hodgsoni*)

Size: Shoulder height of male, 80 cm; females are smaller and hornless

Weight: Male, 35-40 kg; female, 25-30 kg

Habitat: Arid, treeless steppes and grasslands of the Tibetan Plateau, at elevations of 4,300 m and above

Surviving number: Estimated at fewer than 75,000



A scene from *Everest*, a MacGillivray Freeman Film for IMAX® theatres.

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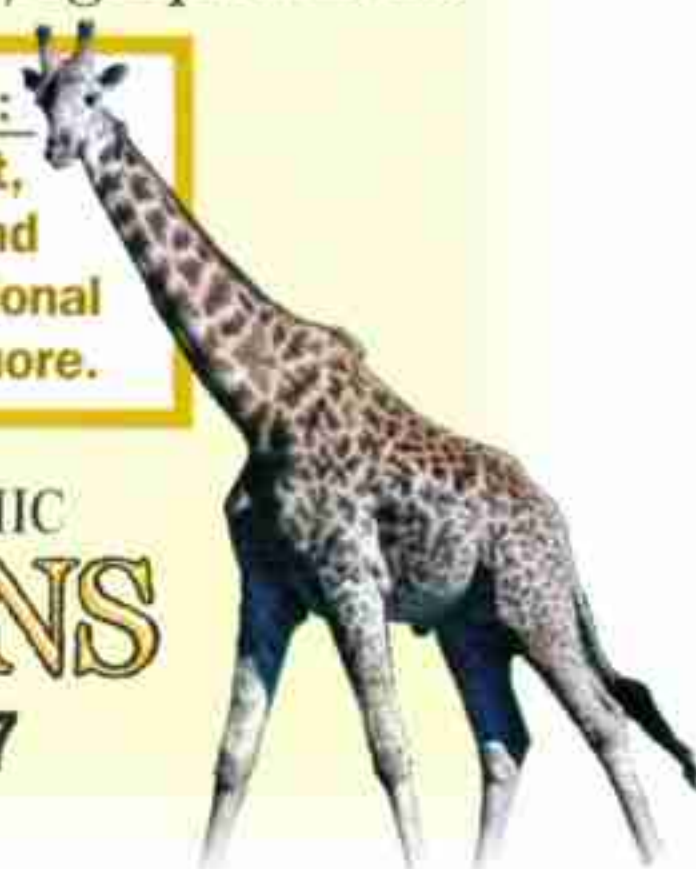
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Behind the SCENES

AT THE NATIONAL GEOGRAPHIC SOCIETY



JOEL SARTORE (ABOVE AND BELOW LEFT)

A Soggy Dry Run

Sending images home to the rain forest

It's not every day that a photographer happily watches his work laid out on a Lincoln, Nebraska, driveway in the pouring rain (above). But Joel Sartore was literally road testing the waterproof properties of laminated



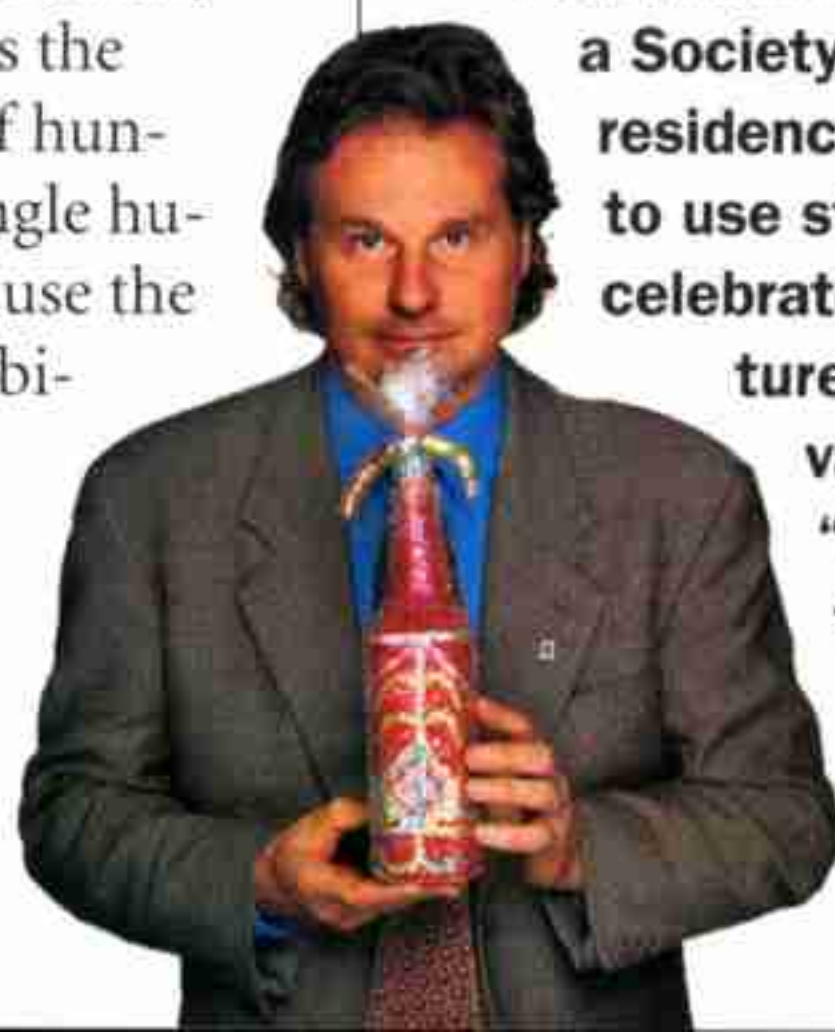
photos from his Madidi Park story (March 2000). He planned to send the prints back to the rain forest with Rosa María Ruiz (left), his guide in Bolivia, who had come to Nebraska to speak at a special exhibition of the photographs. "Regular paper wouldn't last a week in Madidi," explains Joel, who hopes the lamination will ward off hungry insects as well as jungle humidity. Rosa María will use the photos in traveling exhibitions to remote villages to help educate Bolivians about the national treasure that is Madidi.

EXPLORER-IN-RESIDENCE

During his third year at Harvard, restless and eager to see the world, anthropologist **Wade Davis** visited a café where a National Geographic map hung. Dared by a friend to pick a destination, Wade pointed to Amazonia. Within a month he went to live with rain forest tribes. He later returned to Harvard for a

Ph.D. in ethnobotany. As

a Society explorer-in-residence Wade wants to use storytelling to celebrate world cultures and show the value of diversity. "Stories change the world," he says.



NGS PHOTOGRAPHER MARK THIESSEN

A silver Toyota Land Cruiser is shown from a side profile, driving up a steep, rocky incline. The vehicle is positioned in the middle ground, with its front end slightly higher than the rear. The terrain is composed of large, dark, jagged rocks. In the background, a dark, craggy mountain rises against a sky filled with dramatic, orange and yellow clouds, suggesting a sunset or sunrise. The overall mood is adventurous and rugged.

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New York Botanical Garden,
 200th St.,
 New York City.
 Jan 5 1921
 Dear Mr. Grover
 I am sending by Express prepaid
 forty five more paintings of wild flowers.
 I am expecting to give an exhibition of
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 going to ask if you will kindly make your
 selection and return the balance of this
 and last years engagements as promptly
 as possible.
 Yours very truly
 Mary E. Eaton

M.E. Eaton

314

No sign of the enemies. Yet.

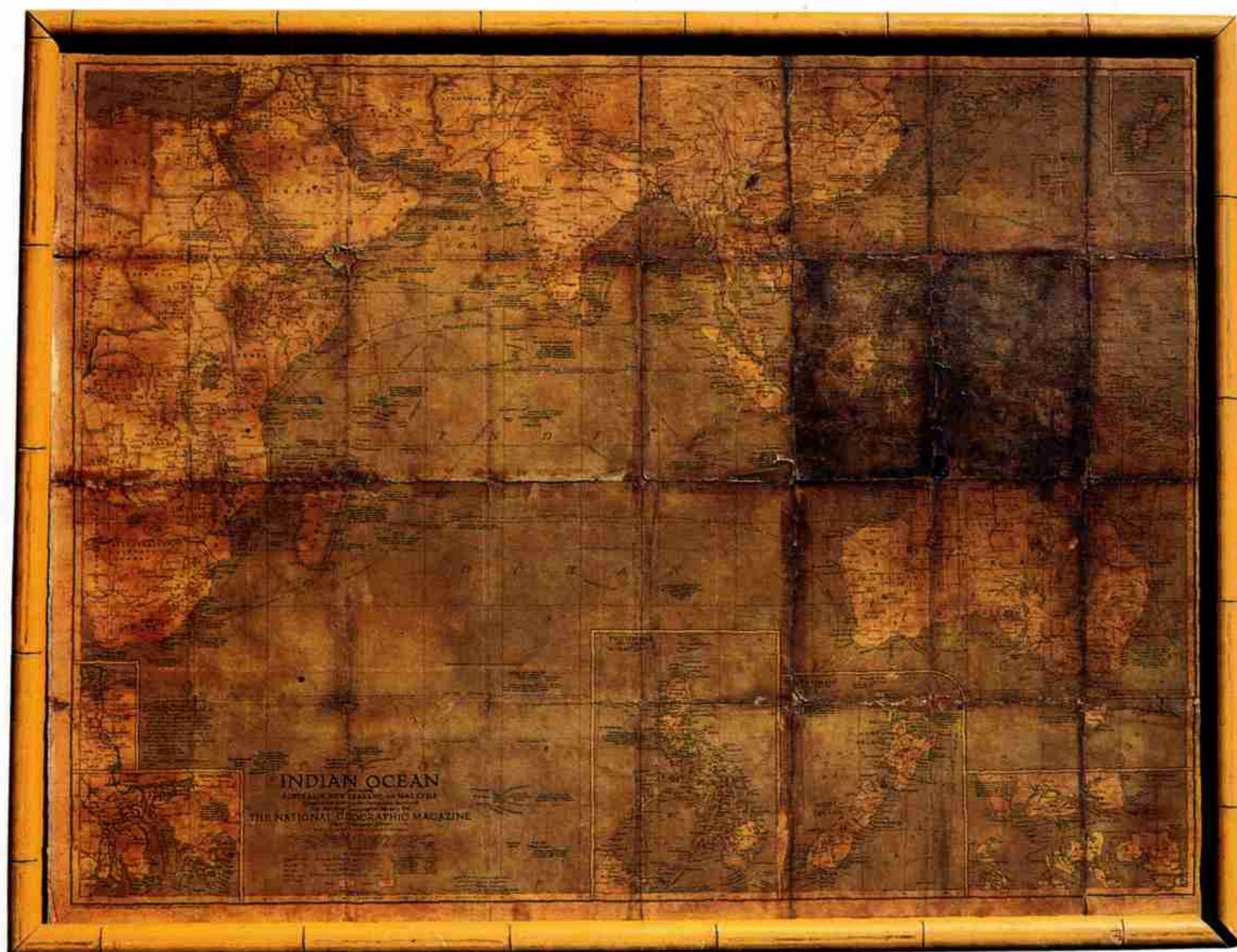
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The Great Escape

Charting their way to safety

It's just an old map of the Indian Ocean, stained with salt water, crumbling with age. It came with the March 1941 issue of the *GEOGRAPHIC*, and no one knows just how American soldiers Damon "Rocky" Gause and William Lloyd Osborne came across it while fleeing the

Japanese in the Philippines in 1942, but it saved their lives.

The Bataan Death March was beginning; they knew they had to escape. With just this map (above) and a compass, they were able to navigate a wooden boat (below) more than 3,000 miles from the Philippines to

Australia. The trip took 52 days, during which they eluded fire from Japanese ships by hoisting a homemade Rising Sun (right). Almost out of drinking water but with luck to spare, the pair reached Australia in October 1942.



COLLECTION OF DAMON L. GAUSE (BELOW LEFT AND ABOVE)

Gause, at right, and Osborne both volunteered for further duty. Gause died in a plane crash in 1944, but Osborne survived service in Burma and was inducted into the Army's Ranger Hall of Fame. Both men wrote accounts of their adventure; Gause's was recently purchased by a Hollywood studio.

And to my dear Uncle Sam, I leave as little as possible.

*I'm Gabriel, 58.
I own a coffee shop,
which I'll make as famous
as that other coffee place
before I pass it on
to my kids.*

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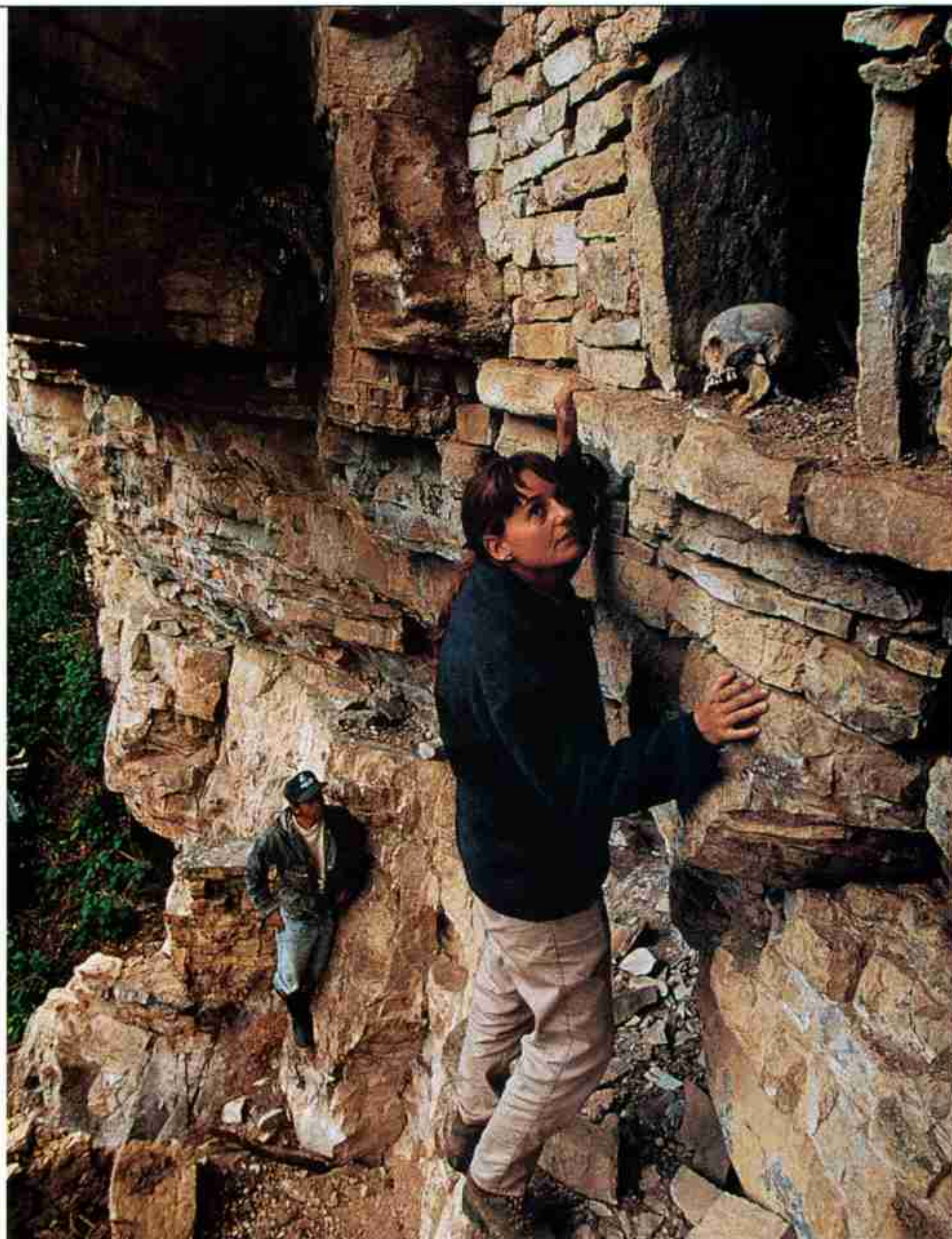


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On the Inca Road

She was born in Switzerland, raised in the United States and Australia, served in the Philippines with the Peace Corps, and trekked through Vietnam. But Karin Muller hadn't seen enough of the world. She dreamed of exploring the network of Inca roads that stretches from Ecuador to Chile. So she set out, traveling more than 3,000 miles by mule, horse, bus, boat, train, plane, and on foot. Karin's adventures included rounding up vicuñas, dancing in an Ecuadorian festival with her face smeared with blackened pig fat, and climbing up to cliffside burial chambers of the Chachapoya (right) in Peru—an ancient culture featured in “Quest for the Lost Tombs” in this issue.

Along the Inca Road, Karin's book published by National Geographic, is available now.



JOHN ARMSTRONG

Behind in His Work

Tired from a long day hiking in Peru with photographer Mark Moffett, biologist Doug Yu initially wasn't sure what he was seeing. When Mark hunkered down to photograph a plant, he seemed to have grown a long, wagging tail. Doug soon realized that Mark was sitting on a very poisonous fer-de-lance snake. “I calmly screamed at him to get up,” says Doug. Snake and photographer escaped unharmed.



ART BY RICHARD THOMPSON

1 0 0 Y E A R S A G O



September 1900

“When night came, and I sat shivering in some fetid hole, not fit for a decent beast, with only a bamboo railing between it and the pigsty, I often thought Chinese traveling an utter abomination.”

—Isabella L. Bird

From her book, *The Yangtze Valley and Beyond*, which was reviewed in NATIONAL GEOGRAPHIC.

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Tiny pumps produce acid in your stomach.



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Delayed-Release Capsules

INDICATIONS AND USAGE

PREVACID Delayed-Release Capsules are indicated for: 1. Short-Term Treatment of Active Duodenal Ulcer. 2. *H. pylori* Eradication to Reduce the Risk of Duodenal Ulcer Recurrence. 3. Maintenance of Healed Duodenal Ulcers. 4. Short-Term Treatment of Active Benign Gastric Ulcer. 5. Treatment of heartburn and other symptoms associated with GERD (Gastroesophageal Reflux Disease). 6. Short-Term Treatment of Erosive Esophagitis. 7. Maintenance of Healing of Erosive Esophagitis. 8. Pathological Hypersecretory Conditions Including Zollinger-Ellison Syndrome.

CONTRAINDICATIONS

PREVACID Delayed-Release Capsules are contraindicated in patients with known hypersensitivity to any component of the formulation.

Amoxicillin is contraindicated in patients with a known hypersensitivity to any penicillin. (Please refer to full prescribing information for amoxicillin before prescribing.)

Clarithromycin is contraindicated in patients with a known hypersensitivity to any macrolide antibiotic, and in patients receiving terfenadine therapy who have preexisting cardiac abnormalities or electrolyte disturbances. (Please refer to full prescribing information for clarithromycin before prescribing.)

WARNINGS

CLARITHROMYCIN SHOULD NOT BE USED IN PREGNANT WOMEN EXCEPT IN CLINICAL CIRCUMSTANCES WHERE NO ALTERNATIVE THERAPY IS APPROPRIATE. IF PREGNANCY OCCURS WHILE TAKING CLARITHROMYCIN, THE PATIENT SHOULD BE APPRISED OF THE POTENTIAL HAZARD TO THE FETUS. (SEE WARNINGS IN PRESCRIBING INFORMATION FOR CLARITHROMYCIN.)

Pseudomembranous colitis has been reported with nearly all antibacterial agents, including clarithromycin and amoxicillin, and may range in severity from mild to life threatening. Therefore, it is important to consider this diagnosis in patients who present with diarrhea subsequent to the administration of antibacterial agents.

Treatment with antibacterial agents alters the normal flora of the colon and may permit overgrowth of clostridia. Studies indicate that a toxin produced by *Clostridium difficile* is a primary cause of "antibiotic-associated colitis."

After the diagnosis of pseudomembranous colitis has been established, therapeutic measures should be initiated. Mild cases of pseudomembranous colitis usually respond to discontinuation of the drug alone. In moderate to severe cases, consideration should be given to management with fluids and electrolytes, protein supplementation, and treatment with an antibacterial drug clinically effective against *Clostridium difficile* colitis.

Serious and occasionally fatal hypersensitivity (anaphylactic) reactions have been reported in patients on penicillin therapy. These reactions are more apt to occur in individuals with a history of penicillin hypersensitivity and/or a history of sensitivity to multiple allergens.

There have been well documented reports of individuals with a history of penicillin hypersensitivity reactions who have experienced severe hypersensitivity reactions when treated with a cephalosporin. Before initiating therapy with any penicillin, careful inquiry should be made concerning previous hypersensitivity reactions to penicillins, cephalosporins, and other allergens. If an allergic reaction occurs, amoxicillin should be discontinued and the appropriate therapy instituted.

SERIOUS ANAPHYLACTIC REACTIONS REQUIRE IMMEDIATE EMERGENCY TREATMENT WITH EPINEPHRINE, OXYGEN, INTRAVENOUS STEROIDS, AND AIRWAY MANAGEMENT, INCLUDING INTUBATION, SHOULD ALSO BE ADMINISTERED AS INDICATED.

PRECAUTIONS

General

Symptomatic response to therapy with lansoprazole does not preclude the presence of gastric malignancy.

Information for Patients

PREVACID Delayed-Release Capsules should be taken before eating.

Alternative Administration Options

For patients who have difficulty swallowing capsules, PREVACID Delayed-Release Capsules can be opened, and the intact granules contained within can be sprinkled on one tablespoon of either applesauce, ENSURE® pudding, cottage cheese, yogurt, or strained pears and swallowed immediately. The granules should not be chewed or crushed. Alternatively, PREVACID Delayed-Release Capsules may be emptied into a small volume of either orange juice or tomato juice (60 mL—approximately 2 ounces), mixed briefly and swallowed immediately. To insure complete delivery of the dose, the glass should be rinsed with two or more volumes of juice and the contents swallowed immediately. The granules have also been shown *in vitro* to remain intact when exposed to apple, cranberry, grape, orange, pineapple, prune, tomato, and V-8® vegetable juice and stored for up to 30 minutes.

For patients who have a nasogastric tube in place, PREVACID Delayed-Release Capsules can be opened and the intact granules mixed in 40 mL of apple juice and injected through the nasogastric tube into the stomach. After administering the granules, the nasogastric tube should be flushed with additional apple juice to clear the tube.

Drug Interactions

Lansoprazole is metabolized through the cytochrome P₄₅₀ system, specifically through the CYP3A and CYP2C19 isozymes. Studies have shown that lansoprazole does not have clinically significant interactions with other drugs metabolized by the cytochrome P₄₅₀ system, such as warfarin, antipyrine, indomethacin, ibuprofen, phenytoin, propranolol, prednisone, diazepam, clarithromycin, or terfenadine in healthy subjects. These compounds are metabolized through various cytochrome P₄₅₀ isozymes including CYP1A2, CYP2C9, CYP2C19, CYP2D6, and CYP3A. When lansoprazole was administered concomitantly with theophylline (CYP1A2, CYP3A), a minor increase (10%) in the clearance of theophylline was seen. Because of the small magnitude and the direction of the effect on theophylline clearance, this interaction is unlikely to be of clinical concern. Nonetheless, individual patients may require additional titration of their theophylline dosage when lansoprazole is started or stopped to ensure clinically effective blood levels.

Lansoprazole has also been shown to have no clinically significant interaction with amoxicillin.

In a single-dose crossover study examining lansoprazole 30 mg and omeprazole 20 mg each administered alone and concomitantly with sucralfate 1 gram, absorption of the proton pump inhibitors was delayed and their bioavailability was reduced by 17% and 16%, respectively, when administered concomitantly with sucralfate. Therefore, proton pump inhibitors should be taken at least 30 minutes prior to sucralfate. In clinical trials, antacids were administered concomitantly with PREVACID Delayed-Release Capsules; this did not interfere with its effect.

Lansoprazole causes a profound and long-lasting inhibition of gastric acid secretion; therefore, it is theoretically possible that lansoprazole may interfere with the absorption of drugs where gastric pH is an important determinant of bioavailability (eg, ketoconazole, ampicillin esters, iron salts, digoxin).

Carcinogenesis, Mutagenesis, Impairment of Fertility

In two 24-month carcinogenicity studies, Sprague-Dawley rats were treated orally with doses of 5 to 150 mg/kg/day, about 1 to 40 times the exposure on a body surface (mg/m²) basis, of a 50-kg person of average height (1.46 m² body surface area) given the recommended human dose of 30 mg/day (22.2 mg/m²). Lansoprazole produced dose-related gastric enterochromaffin-like (ECL) cell hyperplasia and ECL cell carcinoids in both male and female rats. It also increased the incidence of intestinal metaplasia of the gastric epithelium in both sexes. In male rats, lansoprazole produced a dose-related increase of testicular interstitial cell adenomas. The incidence of these adenomas in rats receiving doses of 15 to 150 mg/kg/day (4 to 40 times the recommended human dose based on body surface area) exceeded the low background incidence (range = 1.4 to 10%) for this strain of rat. Testicular interstitial cell adenoma also occurred in 1 of 30 rats treated with 50 mg/kg/day (13 times the recommended human dose based on body surface area) in a 1-year toxicity study.

In a 24-month carcinogenicity study, CD-1 mice were treated orally with doses of 15 to 600 mg/kg/day, 2 to 80 times the recommended human dose based on body surface area. Lansoprazole produced a dose-related increase in incidence of gastric ECL cell hyperplasia. It also produced an increased incidence of liver tumors (hepatocellular adenoma plus carcinoma). The tumor incidences in male mice treated with 300 and 600 mg/kg/day (40 to 80 times the recommended human dose based on body surface area) and female mice treated with 150 to 600 mg/kg/day (20 to 80 times the recommended human dose based on body surface area) exceeded the ranges of background incidences in historical controls for this strain of mice. Lansoprazole treatment produced adenoma of rete testis in male mice receiving 75 to 600 mg/kg/day (10 to 80 times the recommended human dose based on body surface area).



Lansoprazole was not genotoxic in the Ames test, the *ex vivo* rat hepatocyte unscheduled DNA synthesis (UDS) test, the *in vivo* mouse micronucleus test or the rat bone marrow cell chromosomal aberration test. It was positive in *in vitro* human lymphocyte chromosomal aberration assays.

Lansoprazole at oral doses up to 150 mg/kg/day (40 times the recommended human dose based on body surface area) was found to have no effect on fertility and reproductive performance of male and female rats.

Pregnancy: Teratogenic Effects. Pregnancy Category B

Lansoprazole

Teratology studies have been performed in pregnant rats at oral doses up to 150 mg/kg/day (40 times the recommended human dose based on body surface area) and pregnant rabbits at oral doses up to 30 mg/kg/day (16 times the recommended human dose based on body surface area) and have revealed no evidence of impaired fertility or harm to the fetus due to lansoprazole.

There are, however, no adequate or well-controlled studies in pregnant women. Because animal reproduction studies are not always predictive of human response, this drug should be used during pregnancy only if clearly needed.

Clarithromycin

Pregnancy Category C

See WARNINGS (above) and full prescribing information for clarithromycin before using in pregnant women.

Nursing Mothers

Lansoprazole or its metabolites are excreted in the milk of rats. It is not known whether lansoprazole is excreted in human milk. Because many drugs are excreted in human milk, because of the potential for serious adverse reactions in nursing infants from lansoprazole, and because of the potential for tumorigenicity shown for lansoprazole in rat carcinogenicity studies, a decision should be made whether to discontinue nursing or to discontinue the drug, taking into account the importance of the drug to the mother.

Pediatric Use

Safety and effectiveness in pediatric patients have not been established.

Use in Women

Over 800 women were treated with lansoprazole. Ulcer healing rates in females were similar to those in males. The incidence rates of adverse events were also similar to those seen in males.

Use in Geriatric Patients

Ulcer healing rates in elderly patients are similar to those in a younger age group. The incidence rates of adverse events and laboratory test abnormalities are also similar to those seen in younger patients. For elderly patients, dosage and administration of lansoprazole need not be altered for a particular indication.

ADVERSE REACTIONS

Worldwide, over 6100 patients have been treated with lansoprazole in Phase 2-3 clinical trials involving various dosages and durations of treatment. In general, lansoprazole treatment has been well tolerated in both short-term and long-term trials.

The following adverse events were reported by the treating physician to have a possible or probable relationship to drug in 1% or more of PREVACID-treated patients and occurred at a greater rate in PREVACID-treated patients than placebo-treated patients:

Incidence of Possibly or Probably Treatment-Related Adverse Events in Short-term, Placebo-Controlled Studies

Body System/Adverse Event	PREVACID (N=1457) %	Placebo (N=467) %
Body as a Whole		
Abdominal Pain	1.8	1.3
Digestive System		
Diarrhea	3.6	2.6
Nausea	1.4	1.3

Headache was also seen at greater than 1% incidence but was more common on placebo. The incidence of diarrhea was similar between patients who received placebo and patients who received lansoprazole 15 mg and 30 mg, but higher in the patients who received lansoprazole 60 mg (2.9%, 1.4%, 4.2%, and 7.4%, respectively).

The most commonly reported possibly or probably treatment-related adverse event during maintenance therapy was diarrhea.

Additional adverse experiences occurring in <1% of patients or subjects in domestic and/or international trials, or occurring since the drug was marketed, are shown below within each body system.

Body as a Whole - anaphylactoid-like reaction, asthenia, candidiasis, chest pain (not otherwise specified), edema, fever, flu syndrome, halitosis, infection (not otherwise specified), malaise, **Cardiovascular System** - angina, cerebrovascular accident, hypertension/hypotension, myocardial infarction, palpitations, shock (circulatory failure), vasodilation; **Digestive System** - melena, anorexia, bezoar, cardiospasm, cholelithiasis, constipation, dry mouth/thirst, dyspepsia, dysphagia, eructation, esophageal stenosis, esophageal ulcer, esophagitis, fecal discoloration, flatulence, gastric nodules/fundic gland polyps, gastroenteritis, gastrointestinal hemorrhage, hematemesis, increased appetite, increased salivation, rectal hemorrhage, stomatitis, tenesmus, ulcerative colitis, vomiting; **Endocrine System** - diabetes mellitus, goiter, hyperglycemia/hypoglycemia; **Hematologic and Lymphatic System** - agranulocytosis, anemia, aplastic anemia, hemolysis, hemolytic anemia, leukopenia, neutropenia, pancytopenia, thrombocytopenia, and thrombotic thrombocytopenic purpura; **Metabolic and Nutritional Disorders** - gout, weight gain/loss; **Musculoskeletal System** - arthritis/arthralgia, musculoskeletal pain, myalgia; **Nervous System** - agitation, amnesia, anxiety, apathy, confusion, depression, dizziness/syncope, hallucinations, hemiplegia, hostility aggravated, libido decreased, nervousness, paresthesia, thinking abnormality; **Respiratory System** - asthma, bronchitis, cough increased, dyspnea, epistaxis, hemoptysis, hiccup, pneumonia, upper respiratory inflammation/infection; **Skin and Appendages** - acne, alopecia, pruritus, rash, urticaria; **Special Senses** - blurred vision, deafness, eye pain, visual field defect, otitis media, speech disorder, taste perversion, tinnitus; **Urogenital System** - abnormal menses, albuminuria, breast enlargement/gynecomastia, breast tenderness, glycosuria, hematuria, impotence, kidney calculus, urinary retention.

* The majority of hematologic cases received were foreign-sourced and their relationship to lansoprazole was unclear.

Combination Therapy with Amoxicillin and Clarithromycin

In clinical trials using combination therapy with PREVACID plus amoxicillin and clarithromycin, and PREVACID plus amoxicillin, no adverse reactions peculiar to these drug combinations were observed. Adverse reactions that have occurred have been limited to those that had been previously reported with PREVACID, amoxicillin, or clarithromycin.

Triple Therapy: PREVACID/amoxicillin/clarithromycin

The most frequently reported adverse events for patients who received triple therapy for 14 days were diarrhea (7%), headache (6%), and taste perversion (5%). There were no statistically significant differences in the frequency of reported adverse events between the 10- and 14-day triple therapy regimens. No treatment-emergent adverse events were observed at significantly higher rates with triple therapy than with any dual therapy regimen.

Dual Therapy: PREVACID/amoxicillin

The most frequently reported adverse events for patients who received PREVACID t.i.d. plus amoxicillin t.i.d. dual therapy were diarrhea (8%) and headache (7%). No treatment-emergent adverse events were observed at significantly higher rates with PREVACID t.i.d. plus amoxicillin t.i.d. dual therapy than with PREVACID alone.

For more information on adverse reactions with amoxicillin or clarithromycin, refer to their package inserts, **ADVERSE REACTIONS** sections.

Laboratory Values

The following changes in laboratory parameters for lansoprazole were reported as adverse events:

Abnormal liver function tests, increased SGOT (AST), increased SGPT (ALT), increased creatinine, increased alkaline phosphatase, increased globulins, increased GGTP, increased/decreased/abnormal WBC, abnormal AG ratio, abnormal RBC, bilirubinemia, eosinophilia, hyperlipemia, increased/decreased electrolytes, increased/decreased cholesterol, increased glucocorticoids, increased LDH, increased/decreased/abnormal platelets, and increased gastrin levels. Additional isolated laboratory abnormalities were reported.

In the placebo controlled studies, when SGOT (AST) and SGPT (ALT) were evaluated, 0.4% (1/250) placebo patients and 0.3% (2/795) lansoprazole patients had enzyme elevations greater than three times the upper limit of normal range at the final treatment visit. None of these patients reported jaundice at any time during the study.

In clinical trials using combination therapy with PREVACID plus amoxicillin and clarithromycin, and PREVACID plus amoxicillin, no increased laboratory abnormalities particular to these drug combinations were observed.

For more information on laboratory value changes with amoxicillin or clarithromycin, refer to their package inserts, **ADVERSE REACTIONS** section.

OVERDOSAGE

Oral doses up to 5000 mg/kg in rats (approximately 1300 times the recommended human dose based on body surface area) and mice (about 675.7 times the recommended human dose based on body surface area) did not produce deaths or any clinical signs.

Lansoprazole is not removed from the circulation by hemodialysis. In one reported case of overdose, the patient consumed 600 mg of lansoprazole with no adverse reaction.



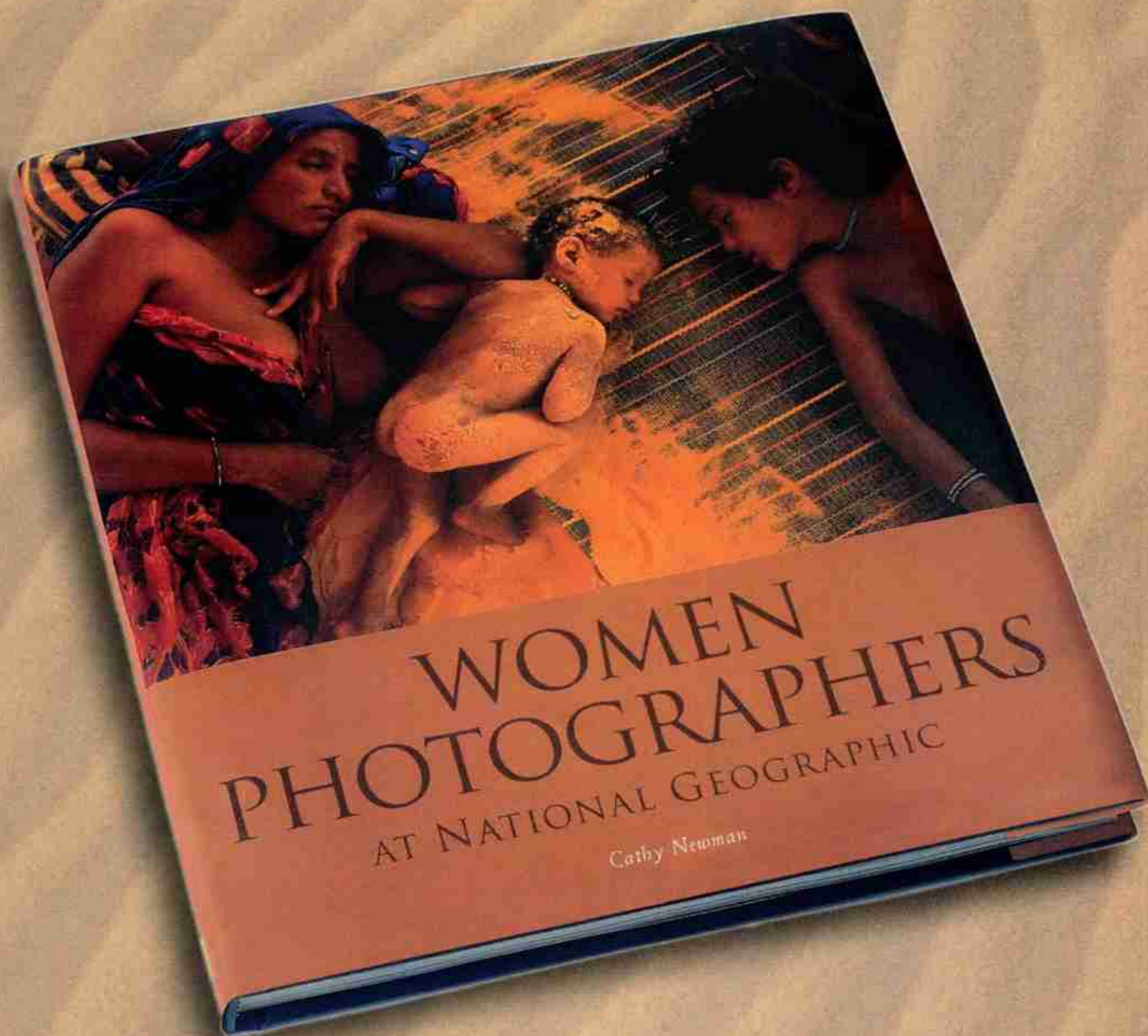
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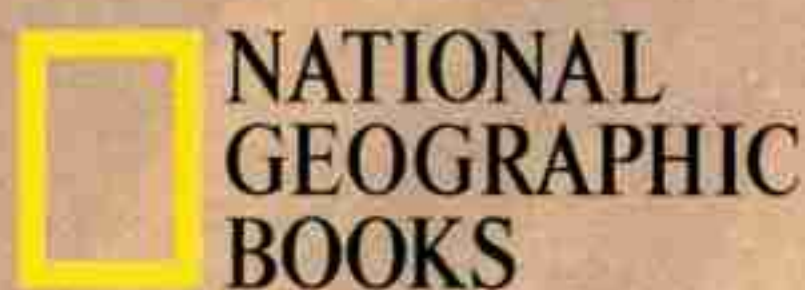
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A fearless little girl named Zoe marches by iguanas in the Galápagos Islands, about 600 miles west of Ecuador. When she arrived there with her parents, Australian filmmakers David Parer and Elizabeth Parer-Cook, Zoe was still in diapers. "She learned to swim with sea lions and saw them being born," recalls Elizabeth. "She would play at being a mother." In *Two Years in the Galápagos*, EXPLORER's look at the filming of the National Geographic Special *The Dragons of the Galápagos*, Zoe is enthralled by the animals ushering in life, while David and his crew risk death to witness iguanas laying eggs in the warm ash of an active volcano. David exults when his cameras catch penguins, pelicans, and blue-footed boobies feeding on a gigantic school of baitfish. Scenes of the frenzy present a rare and gripping look at the ocean food chain in action.

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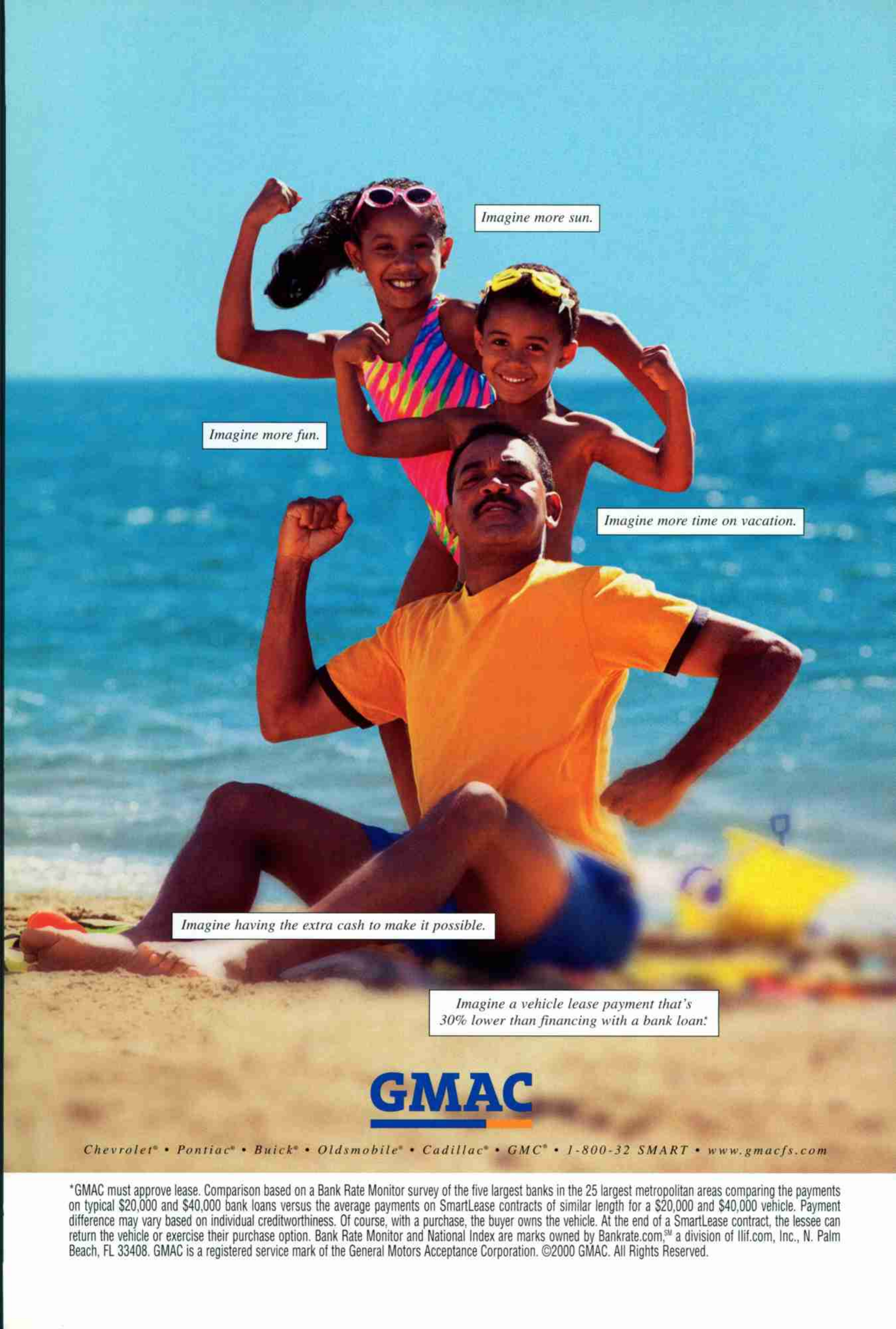
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Ask Us

THE ANSWER PLACE

Our Research Correspondence staff responds to questions from curious readers.

Q In the Northern Hemisphere navigators use the North Star to find their way. What star do they use in the Southern Hemisphere?

A There is no “south star,” but sailors can use the constellation Cruz, or Southern Cross, for approximate direction. The upright of the cross points toward the south celestial pole.

Q Why is the ocean salty?

A Rivers carry salts from rocks to the sea, and undersea volcanoes also produce salts. When ocean water evaporates, the salts are left behind.

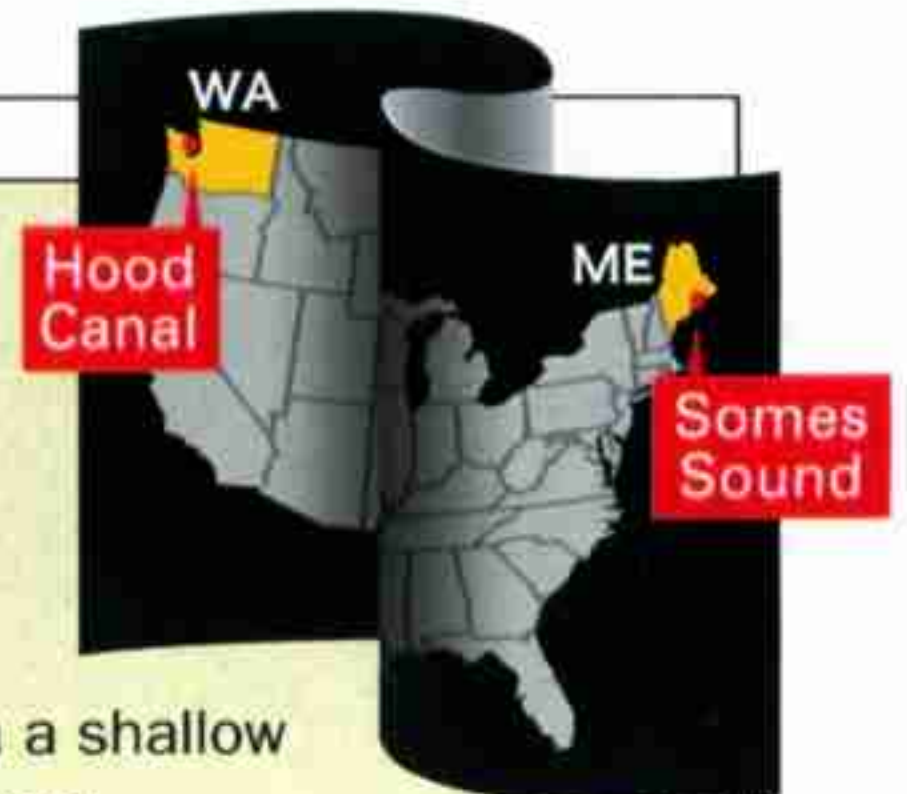
Q Do lions and tigers ever interbreed?

A A few hybrids have been born in captivity. “Ligers” are the progeny of a female tiger and a male lion. The offspring of a male tiger and a female lion are called “tigons.” The male hybrids are thought to be

CARTOGRAPHIC

Q Are there any fjords in the lower 48 states?

A Hood Canal in Washington’s Olympic Peninsula and Somes Sound in Maine are glacially carved arms of the sea with a shallow sill at the mouth—fjords by most definitions.



sterile, but female ligers have been successfully bred with lions, producing cubs that reach adulthood. Tigons and ligers have never been found in the wild.

Q Does water flow uphill anywhere in the world?

A Water flows as gravity dictates: downhill. However, geologic formations sometimes create the illusion that it flows uphill, such as where the Rio Grande cuts through tilted stratification in Santa Elena Canyon on the Texas-Mexico border.

Q If a group of geese is a “flock” and a group of wolves is a “pack,” what do you call a group of bears?

A When bears gather, they do so in a “sloth.” Other curious

terms given to animal groupings include an “ostentation” of peacocks, a “busyness” of ferrets, a “crash” of rhinoceroses, and a “parliament” of owls.

Q Which U.S. town or city has the longest name?

A Winchester-on-the-Severn, Maryland, claims that honor according to the U.S. Board on Geographic Names. The longest one-word, unhyphenated name belongs to Mooselookmeguntic, Maine.

MORE INFORMATION

Send questions to Ask Us, National Geographic Magazine, PO Box 96095, Washington, DC 20090-6095 or via the Internet to ngsaskus@nationalgeographic.com. Include name, address, and daytime phone number.



JODI COBB, NGS

TELL US

Why is this man watering his head? Hint: Every day is a good hair day for young members of the Huli tribe’s bachelor cult in Papua New Guinea.

Think you know the answer? Go online to nationalgeographic.com/ngm/tellus/0009 and test yourself, or read it here in next month’s issue.



WHAT IT TAKES TO BUILD THE

FASTER, FASTER To help his body adapt to greater speeds, a tow pulls Tom Wilkens at a record clip at the Olympic Training Center in Colorado Springs, Colorado.

UNBEATABLE

PUSHING THE LIMITS

MASS MOVEMENT

A kaleidoscopic crowd of 30,000 runners surges across the Verrazano-Narrows Bridge during the New York City Marathon. Most have endured months of training for the reward of crossing the finish line, exhausted and exhilarated, after 26.2 miles.





BY RICK GORE

SENIOR EDITOR

PHOTOGRAPHS BY

JOE McNALLY

HOW FAST CAN I GO?

Can I break a record?"

"Why not?" replies Bill Kaiser, an aquatics specialist for USA Swimming. He snaps a harness around my midsection. I slip into lane one of the 50-meter pool at the Olympic Training Center in Colorado Springs, nod to Kaiser, and shove off the wall.

Suddenly my body feels like a bullet ripping through the water. Never have my arms and shoulders rotated with such power. Each stroke seems to propel me twice the usual distance. I feel instantly euphoric, as if my brain were surging with endorphins.

Kaiser has hooked my harness to a pulley system known as a tow, a training device that drags a high-performance swimmer 5 percent faster than he usually swims. It allows the swimmer to get a feel for the increased speed, adjust his stroke patterns and body rotations accordingly, and eventually swim faster on his own. In my case, the tow is moving almost 50 percent faster than my norm.

Twenty-three seconds later I touch the wall.

"Congratulations," says Kaiser. "You've just beaten Amy Van Dyken's American record for the 50 free."

He's referring to the 50-meter freestyle race Van Dyken swam in 24.87 seconds in the 1996 Olympics in Atlanta. With that and three other events she became the first American woman to win four gold medals in one Olympics.

I'm not an Olympic-caliber competitor. I'm a middle-aged masters swimmer who's won a few medals in my age group.

The human body, *(Continued on page 12)*





FEEL THE BURN As intense as a drill sergeant, instructor Gina Lim Renner exhorts her spin class at the Sports Club/LA to pedal harder if they want to look better. "I get a lot of very driven type A people," she says. "They're here to sweat buckets."

MUSCULAR ART Drama and athletics entwine when members of the Pilobolus dance troupe link bodies to create images like a scorpion, right, and a crowned warrior. Says artistic director Michael Tracy, "Dance is one of the highest realizations of physical form."





I know, did not evolve to swim laps—or to kick a soccer ball or to do somersaults off a ten-meter platform. But as long as humans have had a sense of sport and competition, we have invented ways to push our anatomy to its limits. What are those limits? In this Olympic year I am studying some of the men and women trained to perform as if there were none.

Numerous factors—genetic, psychological, cultural, and financial—go into making a super performer, but the right genes may be the most critical. Elite athletes, as these super performers are called, are in a sense fortunate freaks of nature.

Take their muscles, for instance. The fibers within most human skeletal muscles are close to evenly divided between fast-twitch fibers, which contract very rapidly, and slow-twitch fibers, which don't contract as quickly but generate energy much more efficiently. Olympic weight lifters have an unusual abundance of fast-twitch fibers; these give them the explosive power to jerk hundreds of pounds from the ground to over their heads in a split second. The legs of elite marathon runners, on the other hand, might contain up to 90 percent slow-twitch fibers, giving them the endurance for longer, aerobic activities.

Whether fast-twitchers or slow, however, elite athletes take human performance to a notch we lesser mortals can only imagine. So that I can better understand why I'm among the ranks of those who must imagine, I am escorted to a contraption called the flume.

The flume is like a treadmill in water—a 15-foot-long pool with motors that generate precisely controlled currents. The faster the current, the faster the swimmer has to stroke to stay clear of the back of the pool.

"You're going to swim for three minutes, then rest for two while we take some measurements," says Larry Herr, an exercise physiologist. "Then we'll increase the speed of the current, and you'll swim another three minutes. We'll do that five times, faster in each set."

"This is going to hurt, isn't it?" I say, as a technician straps on a heart-rate monitor.

"You can stop anytime," says Herr.

The technician inserts a mouthpiece connected by two tubes to a monitor that will measure the air going in and out of my lungs as I swim. That will allow measurement of my VO_2 max, or the maximum volume of oxygen I

use per minute while exercising as hard as I can. VO_2 max is strongly influenced by genetics, but training can increase it as the body becomes more efficient at delivering oxygen to the muscles and using it there.

Next, the technician pricks my earlobe for a drop of blood. This will be repeated after each set to measure my lactate level. Lactate is a by-product of the metabolic process that energizes muscles during the initial stage of intense exercise. This process is anaerobic—it does not use oxygen. Soon after exercise begins, the body switches to oxygen-burning, or aerobic, energy pathways, which fuel longer endurance activity. Normally blood vessels deliver enough oxygen to the muscles and remove enough

"THIS IS GOING TO HURT, ISN'T IT?" I SAY, AS A TECHNICIAN STRAPS ON A HEART-RATE MONITOR.

lactate from them to prevent lactate accumulation. But during a sprint the system may fall behind and lactate may build up. Then cellular fluids become more acid, interfering with muscle contraction and causing fatigue. Training increases heart capacity and the body's network of blood vessels. This increased circulation delivers more oxygen and clears more lactate. Thus the muscles can work longer and harder. Coaches measure lactate levels as one way of evaluating an athlete's level of training.

Once my beginning lactate level is established, I'm ready for my first round in the flume. It feels pretty much like a warm-up. After the second round I'm breathing hard. The third round feels like a full-pace effort and leaves me with my heart pounding, but I recover well during the two-minute rest period.

Midway through the fourth round my lungs begin to ache. My kick weakens, and my arms feel as if they're moving in slow motion no matter how fast I will them to pull. The same feeling sets in earlier in the final round. With no laps to count, I lose my sense of time. With no wall ahead of me getting closer—nothing to look at and say, "OK, I can get there"—I feel lost in a time warp of pain. The water feels as thick as mud. I can't finish.

"Your body went acid," says Herr after examining my biochemical (Continued on page 17)



STUDY SPECIMEN Author Rick Gore tests himself against a machine-generated current inside the flume at the Olympic Training Center. Technicians measure his blood lactate level and oxygen flow. Such training innovations help athletes reach their full potential.

INNER WORKINGS OF FITNESS

A well-trained body is an efficient, intricate machine, as shown in views generated by magnetic resonance imaging (MRI). In a study led by Thomas B. Price, a research scientist with the Department of Diagnostic Radiology at Yale University, a group of men of varying levels of fitness worked out on a treadmill for an hour. Among them was an elite athlete, Keith Brantly, a marathon runner and past Olympian. Immediately before and after the exercise, the men underwent MRI scans. Their bodies, encased in a powerful magnetic field, were subjected to short bursts of radio-frequency waves. The resulting data produced detailed views of muscles, bones, and vessels. The scans also revealed metabolic changes in the leg muscles of the men, changes represented in the images at right: The brighter the colors, the harder the muscles had worked.

Keith ran faster and farther on the treadmill than the other men. Yet because of his high degree of fitness, his muscles generated energy far more efficiently and did not need to work as hard. His finely tuned system depends upon the high volume of oxygenated blood that his heart and arteries, made larger through training, deliver to his muscles to power their contractions. His VO_2 max reading, which indicates the amount of oxygen his body uses, is nearly double that of the fit 60-year-old man, Larry, at middle.

On the other end of the fitness spectrum, Salvatore, a sedentary worker, far right, who walked for an hour, showed "muscles lit up from effort," says Price. "He was working harder to do half as much work as Keith."

Color-coding the work of muscles

The colors assigned to the men's leg muscles show how hard various muscles, tested after an hour of exercise, had worked. The better conditioned and more efficient the muscle, the bluer the color. At the opposite extreme, bright yellow reveals an untrained muscle, forced to work harder for less result than the corresponding muscle of a fit person.

PHOTOGRAPHY BY MARK THIESSEN, NGS

MEDICAL IMAGING BY KEN EWARD, BIOGRAFX

EXERCISE STUDY CONDUCTED AT YALE UNIVERSITY SCHOOL OF MEDICINE; STUDY TEAM: THOMAS B. PRICE, RAYNOLD BERGERON, JIM RAMBO, TERRY HICKEY, THOMAS R. McCAULEY, ADAM ANDERSON, JOHN C. GORE, AND DOUGLAS L. ROTHMAN; STUDY SUBJECTS: KEITH BRANTLY, HAROLD GOFORTH, SALVATORE IORIO, RICHARD KENNAN, AND LAWRENCE W. ROSEN



VO₂ max

Expressed in milliliters (mL) per kilo of body weight per minute, VO₂ max refers to the maximum amount of oxygen the body uses during exercise. It is affected by heart rate, by the volume of blood pumped with each heart-beat, and by the muscles' ability to extract oxygen from the blood.

VO₂ max:
41.9 mL

VO₂ max:
35.3 mL

Right
iliac
artery
diameter:
8 mm

Right
iliac
artery
diameter:
6 mm

Larry

Age: 60 years
Weight: 165 pounds
Height: 69 inches
Body fat: 16.2%
Dedicated daily
exercise: 1 hour

Salvatore

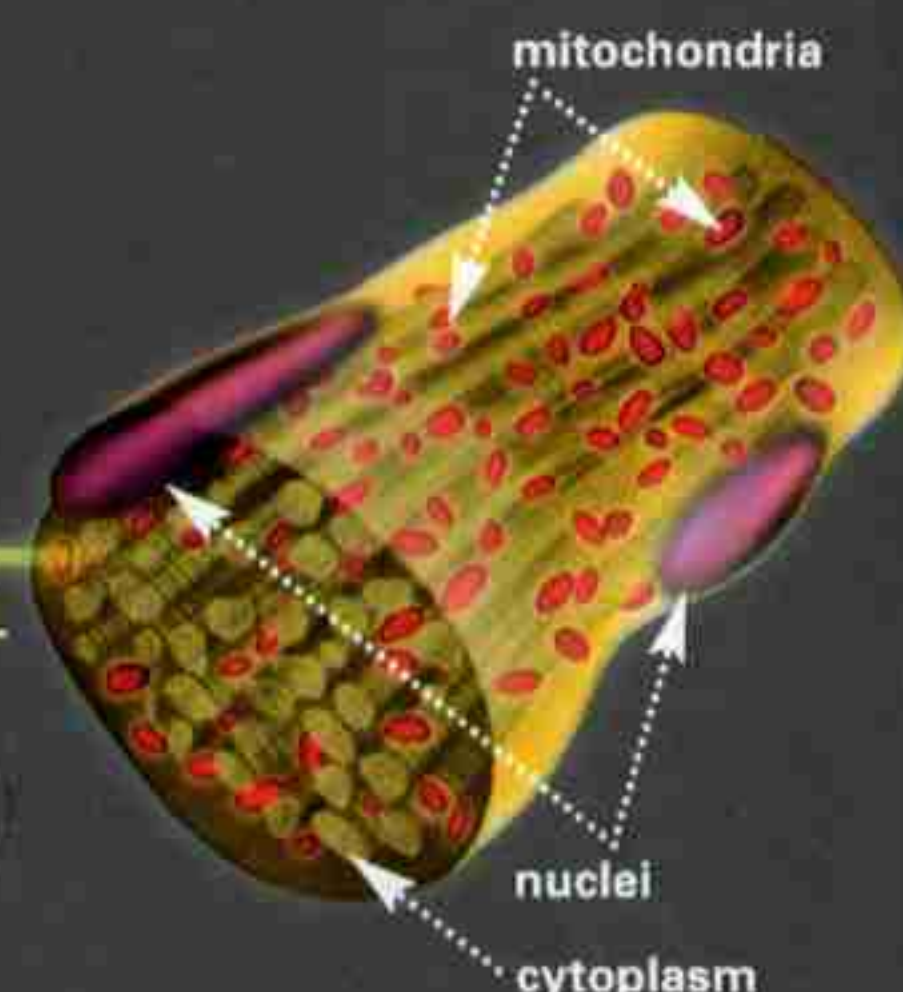
Age: 35 years
Weight: 173 pounds
Height: 68 inches
Body fat: 35%
Dedicated daily
exercise: none

GENERATING ENERGY

For every movement of the body, muscles must produce energy at the cellular level. Activity lasting longer than a few seconds requires the regeneration of the molecule ATP, or adenosine triphosphate, the body's energy carrier. Anaerobic metabolism, which occurs without oxygen, kicks in first by replenishing ATP in a muscle cell's cytoplasm.

The aerobic metabolic process, necessary for prolonged activity, starts with the arrival of oxygen in the muscle. This more efficient system resynthesizes ATP in the mitochondria, the "chemical factories" of the cell. Training increases the number of mitochondria, as shown in the art below comparing an athlete's cell with a sedentary person's.

UNTRAINED MUSCLE CELL





EXPLOSIVE STRENGTH "Everything starts with the legs," says U.S. national champion weight lifter Shane Hamman, who at 360 pounds demonstrates his phenomenal vertical leap. Hamman honed his Olympic lifting technique practicing with a broomstick.

results. "In the third set you hit your lactate threshold—when you couldn't clear all the lactate your muscles were producing." Acidity soared in the next rounds, and my muscles at last shut down. I reached my threshold at about 75 percent of my VO_2 max. The untrained, Herr explains, generally reach the same threshold at around 60 percent of VO_2 max, while trained athletes don't hit that level until they're at 80 to 85 percent. Athletes rich in slow-twitch muscle fibers appear to have higher lactate thresholds.

Elite swimmers regularly approach the heavy lactate threshold of pain. Justin Ewers, an Olympic hopeful from Stanford University, describes it for me. "It's like getting goose bumps with acid in every one, along with deep burning in the lungs and the sensation of dragging lead weights behind you instead of legs." One difference between elites and others is how early the pain starts. "An elite may not feel it until the last three or four seconds of a race. Our training lets us get used to it, and we can ignore it for longer," says Ewers.

Lactate threshold aside, Herr gives me many other reasons why I'll never be an elite swimmer—besides the fact that I'm at least 25 years too old. At five feet nine I'm too short. Most male champions are over six feet—taller, more streamlined bodies mean a longer reach and more productive stroke. And I'm a sinker, meaning too much of my body mass is concentrated south of my lungs, creating excess drag. Also, I don't finish my strokes.

Depressing as these facts are, there's more to life than swimming—especially at the Olympic Training Center. A short walk from the pool is the weight room, where athletes with entirely different genetic gifts are pushing their limits. It sounds like a demolition zone as intensely focused men and women thrust barbells weighing as much as 500 pounds over their heads, then drop them onto padded platforms.

Olympic weight lifting features two types of lifts. In the snatch the lifter propels a heavy barbell from the ground to arm's length overhead in one explosive movement. In the two-part clean and jerk the athlete lifts the bar to shoulder height, then jerks it above his head.

All the lifters have large, powerful thighs. In fact it is the upper leg muscles that initiate the lift by pushing downward into the platform

at the beginning. Then the lifter uses hip, thigh, and back muscles to propel the bar upward. "This sport's different from what most people think," says Matt Rue, one of the lifters. "It's only 60 percent strength. The strongest guy in the world can't do what we do. What you really need is speed and agility and balance. We can all spring up and slam-dunk a basketball from a dead standstill under the hoop."

Surprisingly, a bulky muscle-builder physique is not needed to excel at this sport. More important is a rich supply of fast-twitch muscles, which create the power to heft hundreds of pounds into the air. At about 105 pounds, Tara Nott looks more like the soccer player she once was than a woman capable of jerking 220 pounds. And Jodi Wilhite, a 105-pound teenager from Florence, Texas, was a sprinter on the track team when her high school's football coach spotted her and suggested she try weight lifting.

I see Wilhite at work at the American Open Championships—a qualifying event for the Olympics—in Tacoma, Washington. She walks onto the stage and, her face flashing with effort, jerks 177 pounds—a junior American record for her weight.

Wilhite tells me she is dreaming of the 2004

**"WE CAN ALL SPRING UP
AND SLAM-DUNK A
BASKETBALL FROM A
DEAD STANDSTILL
UNDER THE HOOP."**

Olympics. "But wanting and being there are two different things," she says. Lifters perfect their skills by repeating the same motions over and over until they become almost like reflexes, explains Wilhite. Dragomir Cioroslan, the head U.S. weight-lifting coach in Colorado Springs, had told me: "In one year the average male resident here will lift about seven million pounds in 20,000 reps. It takes thousands and thousands of reps." Wilhite will lift ten million pounds in 80,000 reps between now and 2004.

Greg Louganis, winner of four Olympic diving gold medals, says divers must train the same way: "You have less than three seconds from takeoff until you hit the water, so it *has* to be reflex. You have to repeat the dives hundreds, maybe thousands of times."

Louganis credits his thighs, which a biopsy



HELL WEEK **MAKES OR BREAKS** **NAVY SEALS**

Who are the strong and who are the weak? That's the question Navy instructors set out to answer on a San Diego beach when they subject trainees to a week of almost unimaginable physical and mental stress. Those left standing are considered worthy of becoming Navy SEALs, members of the elite maritime commando force.

Hell Week unveils its tortures during the third week of training at the Coronado Naval Amphibious Base. For five days and six nights recruits are subjected to nonstop physical exercise, from jogging miles in deep sand and carrying heavy rubber boats back and forth to the water to crawling through mud under simulated machine-gun fire and grenade explosions (below). The young men suffer from exhaustion, cold, hunger, and hallucinations.





And that's often after just two days. "We're looking for guys who won't quit under any circumstances," says an instructor.

Recruits are divided into teams of seven. If a team fails to complete a race or an exercise in the allotted time, all its members pay. The slow must lift and carry Old Misery, a 350-pound log (facing page, top). Instructors are merciless. "Do you want to make the cover of *Whiner Magazine*?" one taunts. Another team endures immersion in 60-degree surf (above). "Your body can take it," says an instructor, "but the main question is, can your mind?"

After midnight on the second day a

recruit gives up (below). "He just didn't want to be cold anymore," concluded attending officer Randy Beausoleil. Fewer than half the 60 men lasted the week. "We need more people," admits an officer, "but Mother Nature won't allow us any more."





showed to be especially rich in fast-twitch fibers—75 percent—for some of his spectacular success. The higher a diver can jump, the more time he has to complete the movement. But the kind of training it takes to turn physical gifts into automatic motion requires strong mental as well as physical skills.

Louganis admits his own drive may have been compulsive: “I equated winning medals with winning love. If I had been more psychologically and emotionally balanced, I wouldn’t have—that’s not a real healthy place to be.”

But sport psychologists feel that most consistently successful athletes are psychologically healthy. “They have to be,” says Sean McCann, a sport psychologist at the Olympic Training Center. “Otherwise they couldn’t handle the training loads we put on them. They have to be good at setting goals, generating energy when they need it, and managing anxiety.”

Compulsive or not, Louganis found ways

**THE FLIP SIDE OF
THE INTENSE PHYSICAL
AND MENTAL WORK
THAT ELITE ATHLETES
PERFORM IS THE
EVER PRESENT DANGER
OF OVERTRAINING.**

to manage his own anxieties. “Most divers think too much about it up there,” he says. “They’re too much in their heads. I always tried to shift out of the logical side of my brain. What worked for me was humor. I remember thinking about what my mother would say if she saw me do a bomb of a dive. She’d probably just compliment me on the beautiful splash.”

The flip side of the intense physical and mental work that elite athletes perform is the ever present danger of overtraining—a syndrome that Louganis, like many Olympians, says he confronted. They push so hard they wear their bodies down. “The problem affects about two-thirds of all elite athletes at some point,” says Jack Raglin, a sport psychologist at Indiana University. “They get stale and become prone to infections. Not uncommonly, they develop clinical depression.”

Today most coaches watch carefully for signs of physical and mental strain in order to keep athletes healthy. And few countries devote more energy to maintaining the health of their athletes than Australia, host to the upcoming Olympic Games and one of the most sports-obsessed places in the world.

Some Olympic-caliber Australian athletes live and train at the government-operated Australian Institute for Sport (AIS) in Canberra. They work in state-of-the-art facilities, sleep in dormitories, eat meals tailored to their nutritional needs. A team of experts focuses on their development as parents might, lavishing attention and technology on them. Sport psychologists work with the athletes, teaching techniques for coping with stress, visualizing a winning performance, and setting specific goals, such as beating your best time by a certain date. Physiologists measure lactate levels frequently to help coaches bring athletes to peak performance levels right at competition time. Biomechanics experts analyze minute details of body movement. For rowers they use such tools as instrumented boats that can provide force profiles for every stroke of the oar.

The AIS also runs an intensive program for identifying gifted performers. “An elite athlete is the result of a collision—the right person with the right sport,” says Deborah Hoare, director of the AIS talent identification program. “In a populous country the odds of that happening are much higher than they are here in Australia. We have to make it happen.”

“We’ve modeled the ideal attributes for each sport—speed, strength, or physical traits, for example. Then we go out to high schools to find potential athletes,” says Hoare. AIS scouts put students through a series of tests—jumping, sprinting, balancing. They take measurements as well. Rowers should have long arms and legs for maximum leverage, as well as natural endurance. Basketball players need height, speed, agility, long arms, and vertical jumping strength. With only 19 million people in Australia the institute is determined not to miss any potential Olympians.

Traditionally strong in swimming and rowing, Australia hopes to win medals in other

SHOWTIME Blaine Wilson, four-time U.S. all-around men’s gymnastics champ, displays his strength—and supreme confidence—in executing an iron cross on the rings. “When I do routines before a crowd,” he says, “I don’t think of it as a competition. It’s a performance.”





HIGH-TECH TOOL KIT For each shot taken by ski-shod Carolyn Treacy of the U.S. junior national biathlon team, a laser tracks her aim, a sensor measures trigger pressure, and a camera records the recoil. Behind her, engineer Tim Conrad studies results on a computer.

sports, such as diving, in this Olympics. I visit the Aquatic Centre at Sydney's new Olympic Park for a World Cup diving competition, regarded as a test run for the Olympics. Several dozen female competitors from 30 countries are warming up as I arrive. Attended by a tense silence, the judges take their places alongside the diving well. One by one the divers walk to the edge of the platform and pause, gathering concentration. Then comes a slow, graceful lifting of the arms, a leap skyward, and a twisting, somersaulting dance with gravity. Less

**STERIODS BUILD
UNNATURAL MUSCLE
BULK AND STRENGTH.
EPO ENHANCES
AEROBIC PERFORMANCE.**

than three seconds later, like an arrow, each diver pierces the surface with barely a splash.

"People love to watch this on TV," says Valerie Beddoe, top diving manager of the Australian team. "But not many want to do it. It's hard to learn. It's very technical. It's scary. And it takes years to reach the elite level." Also, as graceful as diving looks, repeatedly hitting the water at more than 40 miles an hour can be brutal on the body.

The intense work, the injury rate, and the pressures of competition—not just for divers but for all elite athletes—can lead to another widespread problem: the temptation to enhance training with such drugs as anabolic-androgenic steroids, which build unnatural muscle bulk and strength.

"Our tests for most drugs are extremely sensitive," says David Gerrard, the physician overseeing the drug testing at the World Cup diving competition in Sydney. "If you tossed a couple of sugar cubes into that diving well, we'd be able to detect it."

Officials conduct unannounced drug tests, and athletes with positive results are heavily fined and disqualified from competition. But two of the most popular drugs used by athletes are difficult to detect. Both occur naturally in the body, but when artificial levels are achieved, their effects become exaggerated. Supplements of human growth hormone (hGH) appear to increase muscle mass and strength. Erythropoietin (EPO), released in greater volume by the kidneys when a person

goes to a high altitude, tells the body to increase production of oxygen-bearing red blood cells. When injected before competition, EPO enhances aerobic performance.

Drugs such as hGH and EPO can cause serious medical complications ranging from arthritis and strokes to liver and cardiovascular disease, but in sports where big money is at stake and the difference between silver and gold may be measured in fractions of a second, athletes seem willing to take the risk. Rampant EPO use scandalized the 1998 Tour de France, and even as I am in Sydney, headlines announce that 22-year-old Australian supercyclist Tim Lyons has been suspended from international competition for two years for tests showing excess levels of muscle-building testosterone.

The Australians are committed to preventing such abuse at the 2000 Olympics. "It's not cricket," says Nicki Vance, program manager of doping control for the Sydney Games. "Sport is terribly important to this country, and we don't want drugs influencing these games. The Olympics won't be coming back to Australia for decades, and we've got to show the world we can do it right."

That won't be easy. In April a scandal hit the country when customs officials seized a bodybuilding hormone ordered from the United States by sport scientist John Pryor, who works with Olympians at the New South Wales Academy of Sport. The drug, called DHEA, is banned by many organizations, including the International Olympic Committee, but is available over the counter in the U.S.

Some athletes' body chemistry is naturally enhanced by their environment. Those raised at high altitudes in countries such as Kenya, Ethiopia, and Morocco have blood that is especially rich in oxygen-bearing hemoglobin—as long as they continue to train at altitude. Cultural factors have also encouraged their bodies to excel at certain sports. "I had to run ten kilometers to school every day," says Tegla Loroupe, a young woman from the pastoral Pokot tribe in northern Kenya. "I'd be punished if I was late."

Loroupe, who has won multiple marathons, including New York City's twice, meets me near the town of Kapenguria, not far from the countryside where she grew up. She now lives



LIVING LARGE Posed with a fellow giant—a 200-pound Burmese python—Chris Cormier flexes his sculpted muscles. With gains in training and nutrition, says the world's third-ranked professional bodybuilder, "physiques are now the best in the history of man."



KENYAN PATH TO GLORY Dreams of travel, gold medals, and prize money energize teenage long-distance runners as they train 8,000 feet high on a ridge above the Rift Valley in Kenya. They attend a camp led by an unlikely coaching star, Brother Colm O'Connell, member of an Irish teaching order. His pupils include many of the runners who, aided by high-altitude training, have dominated marathons and 5,000-meter races for the past 20 years. Photos of local heroes draw admirers at the camp (above). Facilities are modest: Irene Lemika (below) uses a stone for leg lifts. "What we give the kids," says Brother Colm, "is a way of having a better life."



near Hanover, Germany, but has returned to Kenya to train for the European track season.

Loroupe attributes some of her success to the altitude here—about 8,000 feet—and some to her cultural background. "We make the best runners. We are nomads, moving animals from place to place. As a girl it was my job to carry loads of firewood and water from the river."

Today Loroupe, petite at four feet eleven and 86 pounds, runs 120 miles a week. "It's difficult to stay at this level," she admits, "but I have a strong mind. If I want something, I will get it."

Loroupe exhibited her strong-mindedness at an early age, when her father objected to her running because, as he said, it was not what a woman did. She promised that if he sent her and her brother to boarding school, she would stop, but coaches there insisted otherwise. Her mother and sister secretly urged her on. Today she is a national hero, and her prize money helps support a large extended family.



“Last year my father told me he was glad I didn’t obey him,” she says.

A few hours away on the slopes of Mount Kenya, dawn breaking across the African sky, I drive alongside about 50 sleek and determined young runners from the Nyahururu training camp. Roosters crow as their rhythmic pace carries them past missionary schools, country markets, and plots of corn. Their easy, long-limbed stride is as old as this landscape where humans first evolved, but their dreams are of the modern world. They want to be the best—for Kenya, for their fellow runners, and for the big money Kenyans now win in Europe.

The camp is little more than a simple two-story concrete-block dorm on the edge of a farming town. “Most Western athletes wouldn’t want to train here,” says Moses Kiptanui, the camp’s founder. Indeed, the camp lacks the high-tech frills common to training camps in wealthy countries, and the schedule is

grueling. Each day begins early with a run lasting anywhere from 45 minutes to an hour, followed typically by intensive speed work at midday and another endurance run in the afternoon—maybe 15 miles by the end of the day. But complaints are rare. Runners flock to Kiptanui because he has won multiple world championships in distance steeplechases. They also admire his Mercedes.

Leg muscles loaded with slow-twitch fibers carry Kenyan runners to their status as the best marathon runners in the world. But it’s fast-twitch prowess that drives the high-flying athletes on Russia’s national gymnastics teams, dominant in the sport since the 1950s.

The team trains much of the year at remote Lake Krugloye, about 25 miles north of Moscow. The camp, surrounded by snow-buried farmland in winter, is a run-down





MILES TO GO A constellation of swimmers passes overhead off Hawaii's Kona coast during the 1999 Ironman Triathlon. Contestants swim 2.4 miles, bike 112 miles, then run 26.2 miles. Winning time: 8 hours, 17 minutes, 17 seconds—down more than 3 hours since 1978.

complex of institutional brick buildings. But the spacious training gym, outfitted with the most modern equipment, is as bright and warm as a greenhouse the day I arrive. Leonid Arkayev, one of the best and toughest coaches

**"WE TRAIN
THREE TIMES A DAY, SIX
TO SEVEN HOURS, NO
MATTER WHAT.
SEVERE, RIGID
DISCIPLINE. THAT'S
ONE OF THE KEYS."**

in any sport, oversees about a dozen shirtless male gymnasts as they go from parallel bars to high bar to horse to rings.

"They live here," he says. "We train three times a day, six to seven hours, no matter what. Severe, rigid discipline. That's one of the keys to our great success."

Like divers—or pianists—gymnasts must turn their complex movements into automatic motor memories through relentless repetition. As I watch them execute their rituals, Arkayev shouts comments to his protégé Yevgeny Podgorny, who has just finished a sequence on the parallel bars. "That's very good! Watch your legs! Don't catch the bar too soon."

Podgorny mounts the high bar and arcs around it, snapping out of the swing into a somersaulting turn. The next thing I know he's flat on his stomach on the mat. He stands up, shaking his head with disappointment. Arkayev yells something to him in Russian.

"That was a move of the highest difficulty," says Arkayev. "Now I've told him to stop. I can see he is mentally tired. We'll work on it later."

He points out another of Russia's brightest hopes, a five-foot-three, 22-year-old dynamo named Alexei Bondarenko. As he swings on the high bar, I ask Arkayev what makes him good.

"Look at his muscles! They are working muscles," he says—extremely strong and explosively powerful, but not bulky. Bondarenko walks over to us, and when I shake his hand, he feels light, as if he might lift off the floor and fly away. Bondarenko weighs about 120 pounds, and that lightness gives him an advantage. It's a matter of

physics—larger bodies are harder to accelerate and decelerate. Also, at 120 pounds Bondarenko is less likely to suffer joint and tendon damage than a heavier gymnast when he lands on the mat from a height of 15 feet.

Size also explains why most elite female gymnasts are teenagers. Their body mass increases as they mature, making them more vulnerable to injury. And because women add less strength and muscle mass than men as they grow up, they are relatively weaker.

But strength and compact size are only part of the formula that makes an elite gymnast.

"When I was seven," Bondarenko tells me, "my mother brought me to the gym for the first time. I got very excited watching one of the senior boys performing. The coach said to my mother: 'Look at him. He has fire in his eyes. He will be a gymnast!'"

Bondarenko is also a crowd pleaser. "He is a handsome boy," explains his coach, Valeri Alfosov. "And he has a great aesthetic sense. That's important for gymnastics. You not only have to perform the movement correctly, you have to carry your body in the most beautiful way."

Fate did not bless Jason Wening with the same gifts as the Russian gymnasts. But glancing over at him as we're crouched on the blocks, about to begin a 100-yard freestyle race, I realize that more than any athlete I've met, this tousle-haired guy from Ann Arbor, Michigan, embodies the spirit of the world-class athlete. He knows what it means to conquer the unconquerable.

Wening, holder of six world records in disabled swimming, was born with multiple birth defects, and doctors amputated his deformed feet in childhood, leaving him with stumps just below the knee. One of his hands is, as he puts it, "goofy," meaning it has only three fingers.

"I got lucky with my parents," he says. "I am the oldest son of three, and they never treated me differently. When I was younger, I had a lot of difficulty coming to terms with why I was born the way I was. Who was to blame? Then I discovered disabled swimming, and I made this very conscious choice to be very

WONDER BOY Anton Neudakin at age 13 exhibits the taut strength and stoic resolve that breed success in the elite realm of Russian gymnastics. A government program identified Anton as star material at age six. He hopes to leap to fame in the 2004 Athens Olympics.



good at it. I decided to set a world record.”

Wening set his first record in 1991 at age 16. To compensate for his lower body, he focuses intensely on the most minute details of his stroke, down to the position of his pinky finger as it enters the water. He also swims at least three hours a day.

As our race begins, I have the advantage of a leg-driven spring into the water—Wening has to lunge off the blocks from a kneeling position. But as hard as I push, this driven swimmer with barely any kick sweeps past me and beats me by about ten yards.

I tell him he’s an inspiration, and he shrugs it off. “Why should I be more inspirational than any other athlete you’ve met?”

I REALIZE THAT MORE THAN ANY ATHLETE I’VE MET, HE KNOWS WHAT IT MEANS TO CONQUER THE UNCONQUERABLE.

For one thing, no one pays disabled athletes tens of thousands of dollars for winning a gold medal. No one is paying big money for their endorsements or offering stipends so they can train full-time.

“Why do you do it?” I ask.

“For the simple pleasure,” he says after some thought, “of forcing the body and mind I was given to the absolute edge of my capabilities. I’m fascinated by trying to go ever faster. And when I do, I get for just a moment a vision of the limitless potential of the human race.”

A few weeks later, back home at swim practice, I find my own inspiration in Wening’s words. I had been thinking for a while that my best swims were behind me and that my fastest time for the 100 free would remain just that.

“How fast can I go?” I start to wonder after a particularly painful sprint. It’s not a simple question. The human form has its limitations. And I know the set of genes I got would never have made me world class in any sport. Yet the limits of human performance are set not just by our genes but by our heads as well. I get ready for the next sprint. How fast can I go this time? I’m the only one who can find out. □

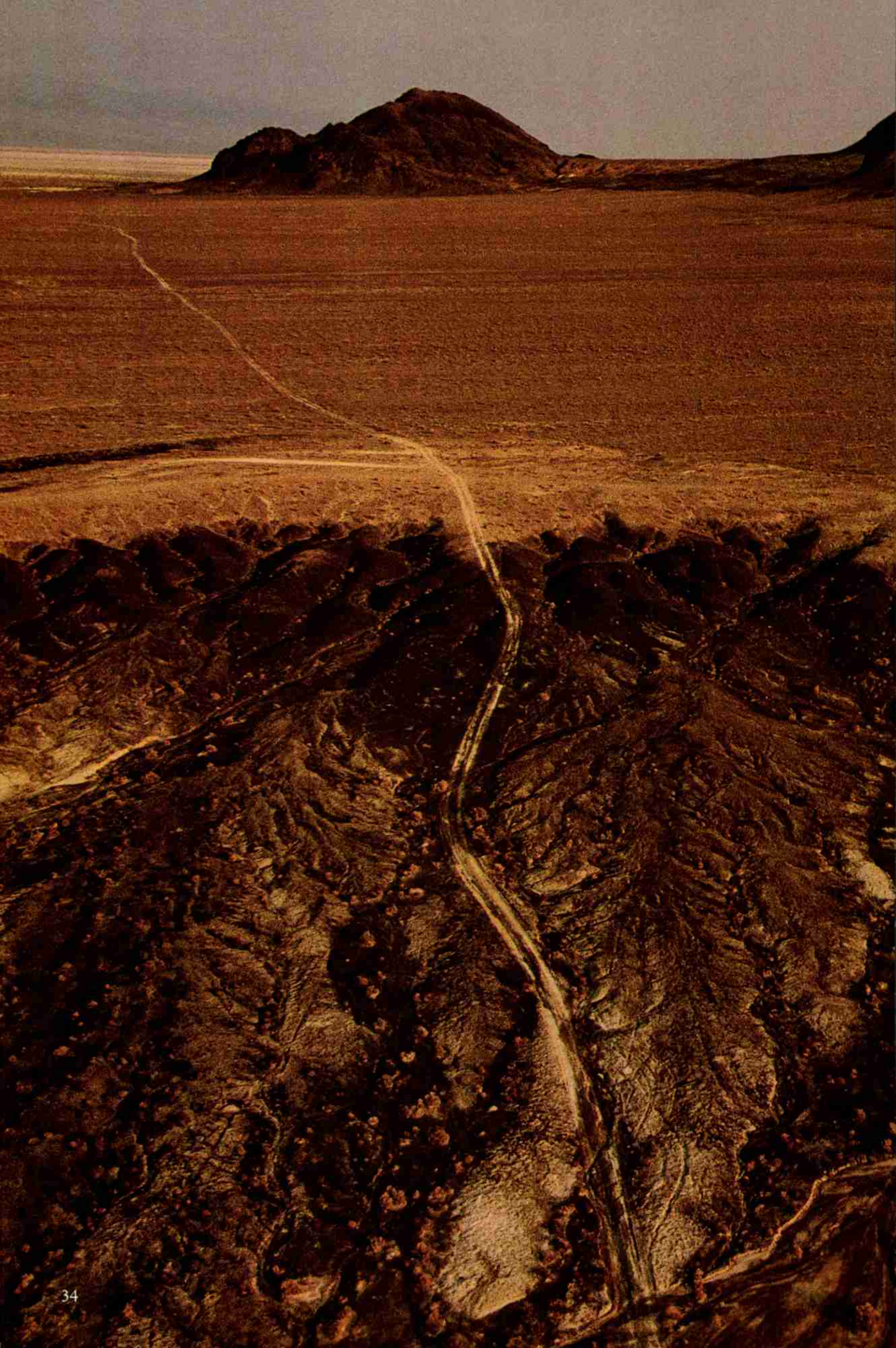
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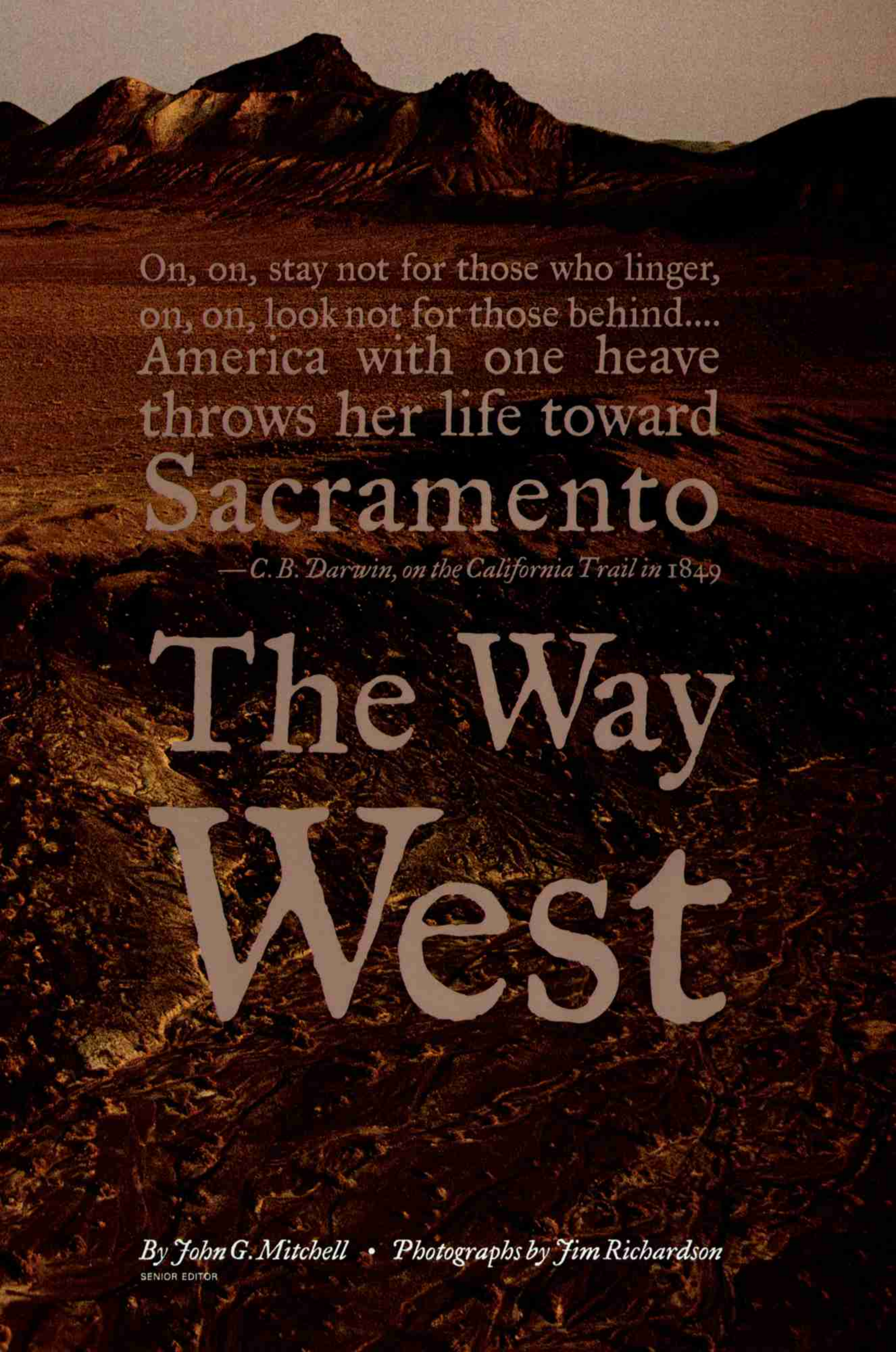
For pictures and tips from photographer Joe McNally, available exclusively on our website, go to nationalgeographic.com/ngm/0009.





GIANT STRIDES In swimming—and winning—Jason Wening shapes his own possibilities. Despite the loss of his lower legs, he holds six world records in disabled competition. He swims eight miles a day in a Michigan pool. Says Wening, “I never want to finish second.”





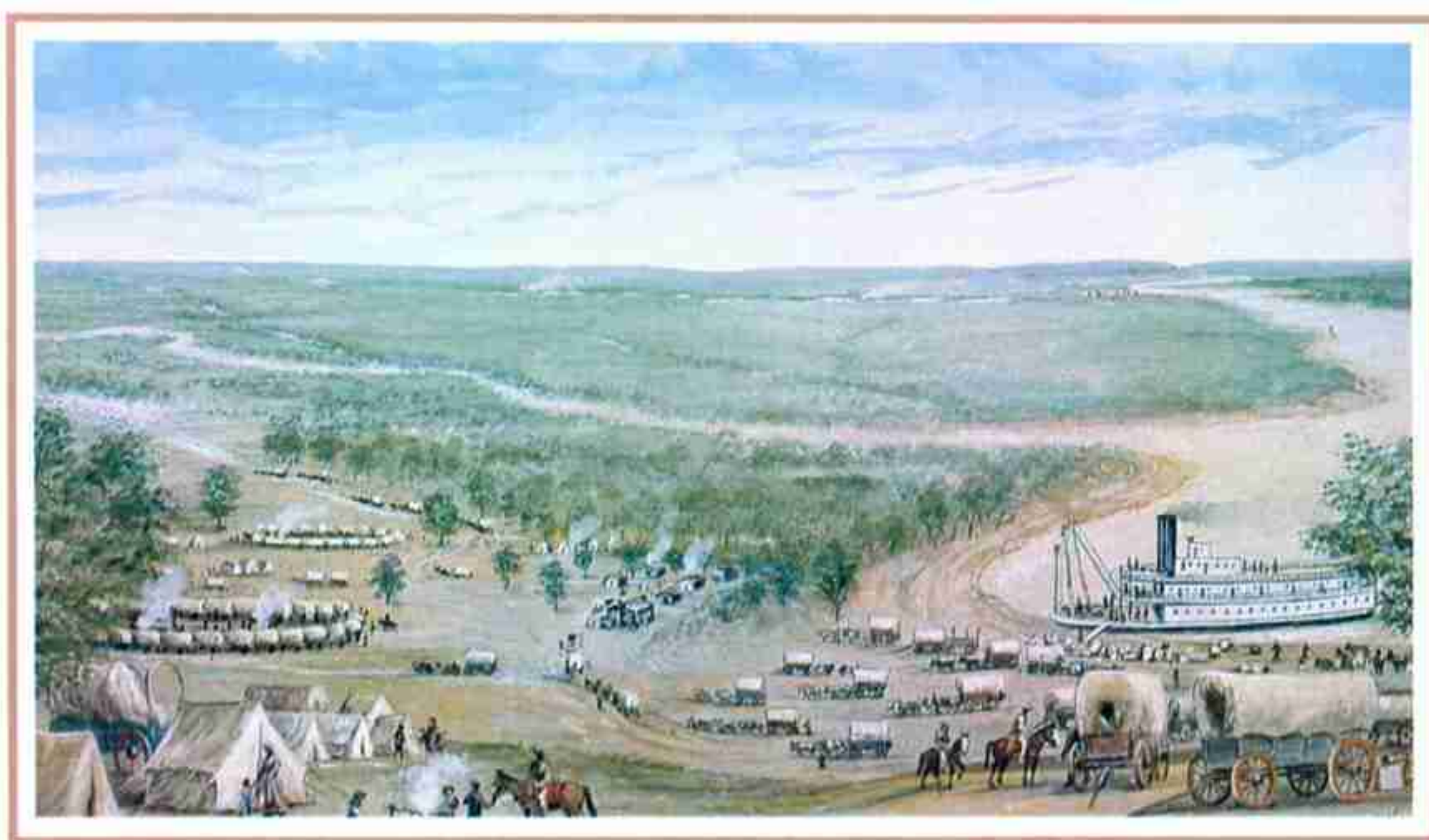
On, on, stay not for those who linger,
on, on, look not for those behind....
America with one heave
throws her life toward
Sacramento

—C. B. Darwin, on the California Trail in 1849

The Way West

By John G. Mitchell • Photographs by Jim Richardson

SENIOR EDITOR



"WESTPORT LANDING" (MISSOURI); ALL PAINTINGS FROM SCOTTS BLUFF NATIONAL MONUMENT, NEBRASKA

THE NAYSAYERS SAID it couldn't be done. You'd have to be crazy to try it. No one had ever rounded up a party of tenderfoot emigrants, pointed their noses toward sundown, and, without benefit of compass or reliable map, dared them to bet their boots and wagons—and lives—against the fearsome 2,000 miles between them and California. But at the far edge of Missouri, where the United States of America had come to a full stop, sundown madness was in some people's blood. They *had* to try it. So in the spring of 1841, with prairie grass greening up beyond the oak openings, a handful started west. No matter that they'd have to abandon their wagons on the arid plains and slaughter their livestock to survive in the mountains. All those who stayed the course—34 there were—got to California with their boots on. It had never been done that way. But they did it.

"I am satisfied that an immense emigration will soon swarm to this country," one Anglo-American immigrant in Mexican California observed a few months after the arrival of those pioneering overland travelers. "It is an object I much desire . . . to have this country inhabited by Americans."

And swarm they did. In 1848, the year Mexico ceded California to the United States and gold was discovered at Sutter's Mill, California could claim a population of some 14,000 Anglos and Hispanics. By the end of

Preceding pages:
The Applegate Trail, Nevada. Such cutoffs from the Oregon-California Trail sought to shorten the emigrants' arduous and dangerous journey. The Applegate opened a new northern route into California, this month marking 150 years as a state.

LEAVING MISSOURI

“No pen can adequately describe our start. Half-a-dozen circuses combined in one would have been tame in comparison. Not one of our 300 mules . . . had ever had a bit in its mouth or a collar on its neck.”

—*Bernard J. Reid, recalling his 1849 journey*

1849 emigration by land and sea had pushed that number past 100,000—sufficient hands, in fact, for folks to start demanding that the territory be admitted to the Union, which it was, on September 9, 1850. Californians ever since have attributed much of their early good fortune to square-rigged seafarers and stampeding gold seekers, too often forgetting that in the span of just one generation, even after most of the lodes had played out, nearly a quarter million emigrants came into the promised land the old-fashioned way, afoot and by wagon on the California Trail.

By some accounts the scant surviving ruts of that trail reflect one of the greatest human migrations in recorded history. Surely no other overland emigration anywhere in the world covered so many miles in so short a time. In the migration's peak years, 1849-1852, travelers described the scene as having the appearance of an army on the move, like a deluge of mortals not seen since the Goths sacked ancient Rome. At Chimney Rock, in what is now Nebraska, footsore Solomon Gorgas sat in the sagebrush watching the wagons of 1850 roll by. In his diary he called it a spectacle “which the world since its creation never has witnessed.”

The spectacle started at the Missouri River, where feeder trails lit out from Independence, Westport Landing, St. Joseph, Council Bluffs, and other frontier towns to converge near Fort Kearny on the River Platte. From the Platte's north fork the trail picked up the Sweetwater River, crossed the

Great Divide at South Pass, then dodged one mountain range after another on its way to Fort Hall, a fur post on the Snake River. A bit beyond the fort the main trail split. The right-hand fork—the homestretch of the Oregon Trail—continued down the Snake toward Oregon. The left fork turned southwest toward California. In the 1850s some Oregonians liked to claim that at another place where the trails diverged a pile of gold-bearing quartz showed the path to California, while a signpost with a written legend guided the traveler toward Oregon. Those who couldn't read, the slur alleged, went to California.

Nowadays, with both of the old traces designated national historic trails, the way west is cluttered with signposts interpreting the story of the great migration. Descendants of the emigrants regularly revisit the journey, as many did last year to commemorate the 150th anniversary of the gold rush. A latter-day wagon train, restricted for the most part to county roads and rural lanes, jumped off in April from St. Joe to Sacramento. I caught up with it a few weeks later on a windy day near Marysville, Kansas, and

FORDING THE PLATTE

“It was an exciting scene, the long train half submerged in the wide expanse of water, the splashing and floundering of the mules, the whoops and yells of the men, and the foam and roar of the dashing waters.”

—*Isaac J. Wistar*, 1849

remanded myself into the custody of a wagon master named Ken Martin.

Martin, a Marysville package-store owner with a white mustache and a cowboy hat to match, told me that his great-grandfather had made the trek with some forty-niners, probably camping nearby, as many did, at Alcove Spring. During a layover to rest the caravan's mules, Martin and I slipped away and found the place much as the emigrants might have in the 1840s. A large spring, one traveler had noted, “gushed from a ledge of rocks. . . . from which falls a beautiful cascade of water.” Altogether, the writer went on, it was “one of the most romantic spots I ever saw.”

At the edge of the cascade Ken Martin was telling me about his ancestor, Simon Oliver Martin of Bourbonnais, Illinois. “He took off from St. Joe in April of 1849, so that's why in 1999 I basically wanted to follow his footsteps. He went out there and panned for gold northwest of Yosemite for about four years before he came back East.”

“How big did he strike it?” I asked.

“I don't know,” Martin said. “If he *did* strike it, it sure never came all the way through to me.”

In the longer view of the great migration, gold was only one of many

Watercolors illustrating this article are by WILLIAM HENRY JACKSON (1843-1942), based on scenes he sketched along the Oregon-California Trail while working as a bullwhacker in the 1860s. His best known work, however, depicts the West in photographs.

incentives that lured the wagonfolk west, and a transient incentive it was at that. More lasting, no doubt, was the human hunger for fertile land. Yet why would a man pack up his family and set out on a four-month journey—a venture described by one newspaper as “palpable homicide”—when cheap and arable land aplenty was still ripe for the picking in the frontier states of the Mississippi Valley?

Perhaps there were as many motives as there were travelers to act on them. Or perhaps there was some common and powerful abstraction that posted those dauntless thousands down the trail: that sundown madness, the springtime stirring of the blood, the gravitational pull of the West. A politician might have attributed it all to Manifest Destiny and the course of empire. But that could not begin to explain the American people’s westering tilt, and only the Pacific Ocean would prove big enough to stop it.

Consider the case of John Bidwell, the “prince of pioneers.” That’s what they called him after he headed west in 1841 to do what had never been done. Restless Bidwells had been tilting west for 200 years, from East Anglia with the first wave of English to Connecticut, across New York to Pennsylvania and, later, Ohio. Some folks then seemed to believe that when the bark popped off the fence rails, it was time to move on. John Bidwell moved on from Ohio when he was barely 20. He had been struck by a desire to see the great prairies of Illinois, Iowa, and Missouri, and when he got to the prairies, here was this French fur trader, one Antoine Robidoux, speaking of a terrestrial paradise called California.

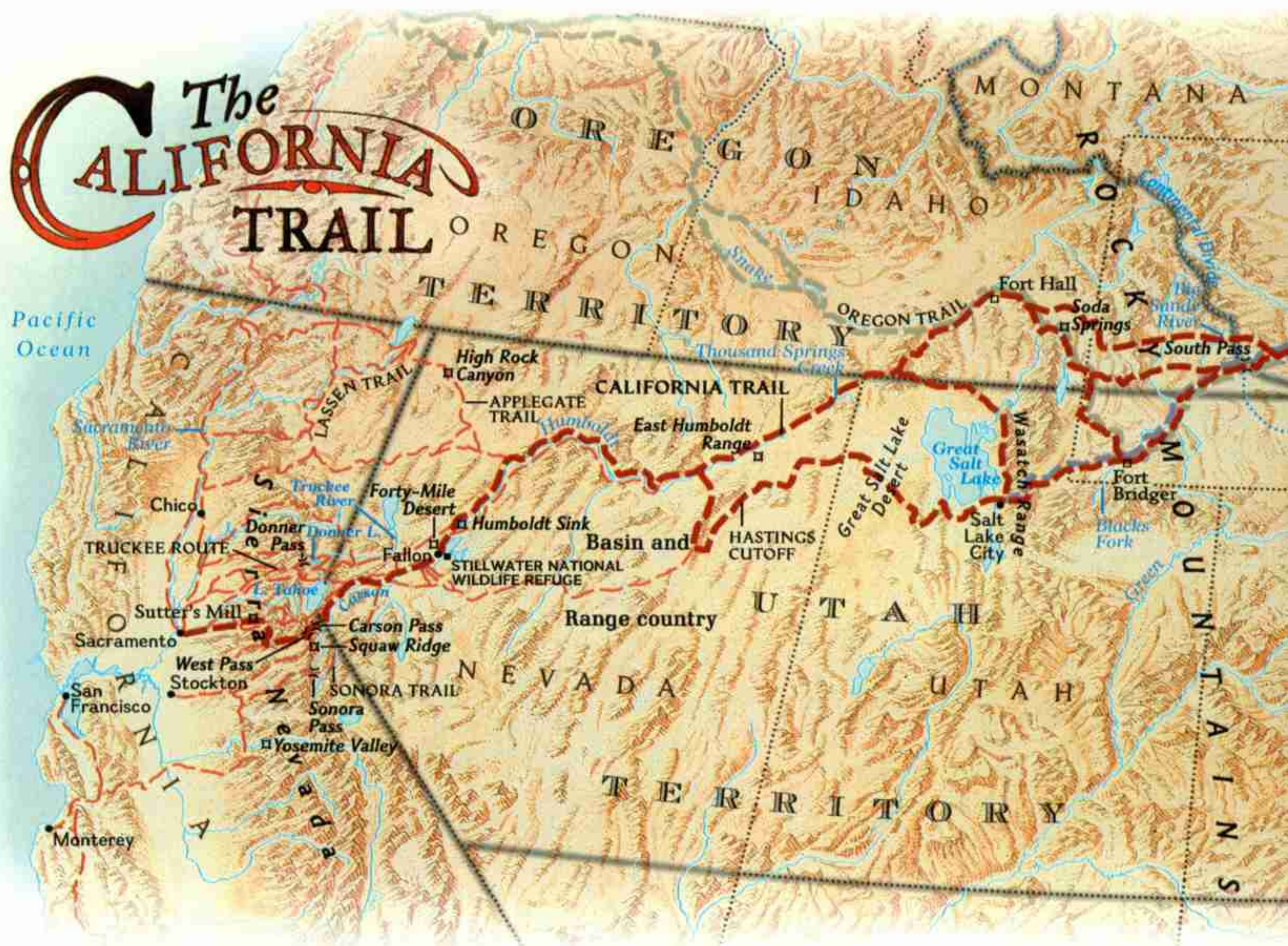


"CROSSING THE SOUTH PLATTE" (NEBRASKA)

May 1841. Bidwell starts west with his emigrant party and some missionaries. The missionaries are headed for Flathead Indian country, toting salvation to the savages. Luckily for the emigrants, the missionaries have retained the services of a veteran mountain man who knows the way to South Pass and beyond, though not to California. His name is Thomas Fitzpatrick. The Rocky Mountain tribes know him as Broken Hand, in tribute to a wounded fist.

Bidwell has been elected secretary of the emigration company. The detailed diary he keeps enables him in later life to render two narrative accounts of the epic journey. Of the Platte, he recalls encountering danger from “innumerable heads of buffalo” thundering down to the river to drink. “We sat up all night shooting at them,” he writes, “to keep them from running over us.”

August 11, 1841. The overlanders have come to a parting of the ways at Soda Springs. Bidwell writes: “Many who purposed in setting out to go immediately through to the California, here concluded to go into Oregon.” And in a later account: “After getting all the information we could from Captain Fitzpatrick we regretfully bade good-by to our fellow emigrants. . . . We were now thrown entirely upon our own resources. All the country beyond was to us a veritable *terra incognita*, and we only knew that California lay to the west.”



Some 2,000 miles and 120 days lay between Independence and the end of the main trail in Sacramento. Leaving Missouri in April or May meant reaching South Pass in July and crossing the Sierra in August or September—with luck, ahead of winter.

Mid-September 1841. The California-bound begin to jettison their wagons and belongings in the desert of a land not yet known as Nevada.

October 22. "... killed the last ox—let this speak for our situation and future prospects."

Early November. "Our journey at an end. . . . After six months we had now arrived . . . in California."

It was more of a beginning than an end for Bidwell. In time he would serve in John Frémont's California Battalion during the Mexican War, acquire a huge ranch at Chico, win a seat in the U.S. House of Representatives, run unsuccessfully for governor of California, and fail in his bid for the presidency of the United States on the Prohibition ticket in 1892. A few years later, while clearing brush at his ranch, Bidwell dropped dead of a heart attack. He still had his boots on.

BEFORE THE FIRST TRANSCONTINENTAL RAILROAD stitched the country together in 1869 and pretty much brought an end to the covered-wagon traffic, the trail that Bidwell pioneered wasn't the only way a traveler could get to California. By land one might have selected a southwestern passage from the Missouri settlements over the Santa Fe Trail and assorted traces across what is now Arizona. Other trails, popular among gold rush Texans, crossed Mexico into southern California.

But the most popular overland route throughout the 1840s was the main trail along the Platte to South Pass. By the end of '49 it had posted more than 27,000 settlers and argonauts to California. And in its peak year, 1852, even as other routes wooed increasing numbers of travelers, 50,000 emigrants would funnel through the pass on their way to the nation's newest



THE MIGRATION

Numbers of emigrants on the California Trail in years preceding and following California statehood.

1841-48	2,735
1849 gold rush	25,000
1850	44,000
1851	*1,000
1852	50,000

*Few emigrants risked the journey in 1851 because of high mortality from cholera in the previous year. An estimated 20,000 died on the trail between 1841 and 1859—ten graves for every mile of wagon ruts.

SOURCE: JOHN D. UNRUH, JR., *THE PLAINS ACROSS*

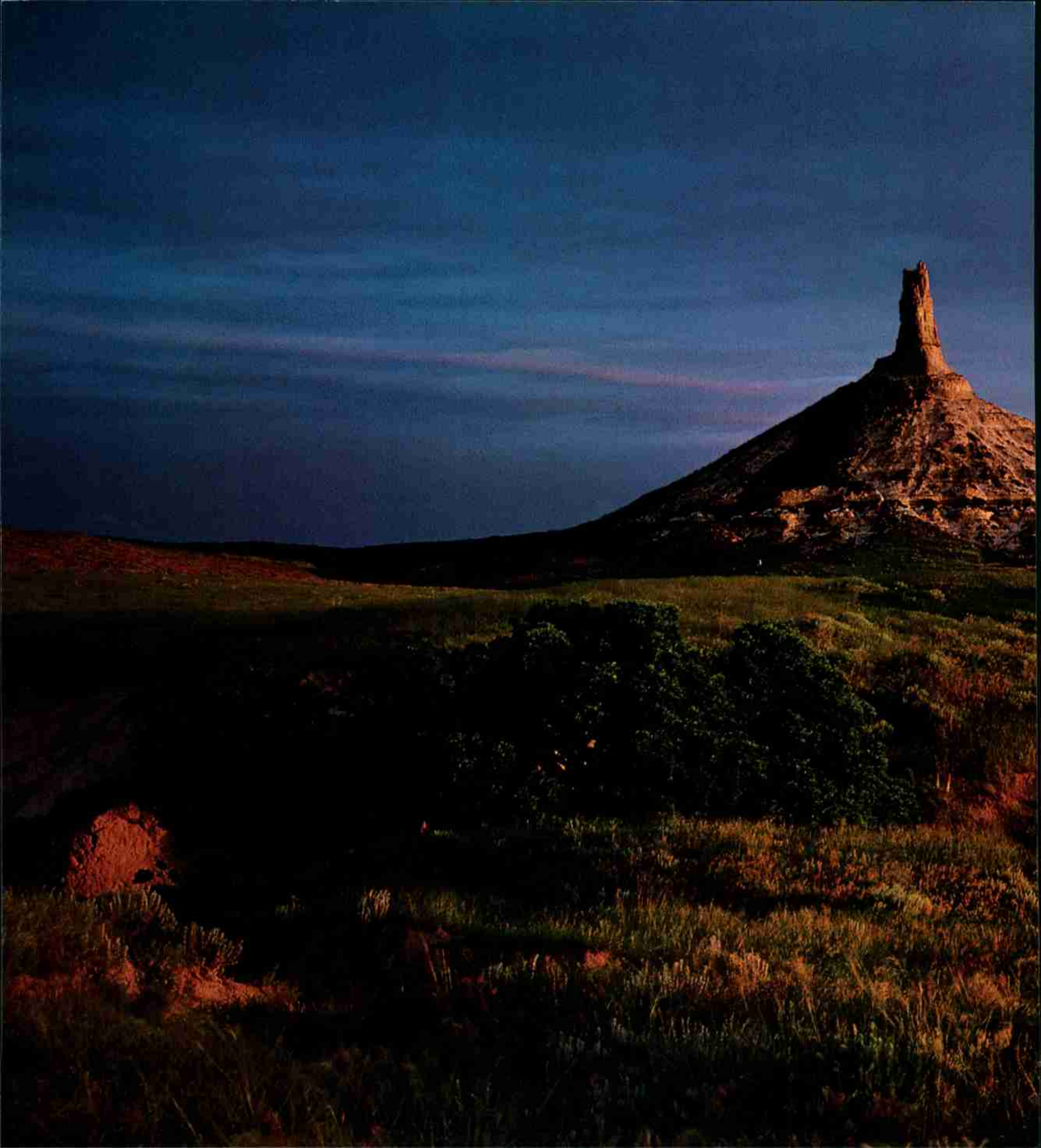
state. As the overlanders sought ways to shorten the miles, various cutoffs began to span the trail's meanders.

From the eastern seaboard states most travelers went by sea. There was the long voyage around Cape Horn; or one could put in at the Isthmus of Panama or Nicaragua, cross through the steaming jungle to the Pacific side, and arrange passage there by ship to San Francisco.

Time and cost—and propaganda—had much to do with the route a person might choose to follow. Not counting the effort and expenditures getting from one's front door to trailhead or dockside, the California Trail compared rather favorably with its competitors. Hitting that trail, an individual could expect to spend from 16 to 22 weeks in transit and from \$100 to \$200 for supplies. Taking the sailcloth way around Cape Horn, some travelers could get to California for less than \$150, but depending on the quality of the vessel and the vicissitudes of wind and weather, the voyage lasted anywhere from 17 to 34 weeks. Running the Central American gauntlet was generally faster, but it was more expensive and there were risks: malaria in the jungle and the uncertainty of connecting with a north-bound ship on the other side of the isthmus.

By and by, as the ocean routes became more popular, Missouri merchants and newspaper publishers found their best interests would be served if they could tout the South Pass venue at the expense of the competition, especially as the ill-equipped settlers and gold rushers were likely to arrive at their river trailheads eager to purchase supplies. According to the historian John D. Unruh, Jr., the Missouri press claimed that the trip across the plains landed one in California fresh, vigorous, and ready for success, while a passenger by sea became "stiff and

(Continued on page 52)



CHIMNEY ROCK (NEBRASKA)



“RAISING CAMP AT DAYLIGHT we resumed our way, and soon afterwards arrived opposite the ‘Chimney’.... How came such an immense pile so singularly situated? What causes united their aid to throw up this lone column, so majestic in its solitude, to overlook the vast and unbroken plains that surround it?”

—*Rufus B. Sage*, 1841

"The hills all covered with a luxuriant carpet of green grass waving in the wind and gleaming in the sunshine all conspires to render the scenery irresistably enchanting and thrill all the soul with that rapturous extacy which Beauty, Freedom, and perfect felicity alone can inspire."

—Edward A. Tompkins, 1850



KANSAS PRAIRIE

"I went to the rock for the purpose of recording my name with the swollen catalogue of others traced upon its sides; but, having glanced over the strange medley, I became disgusted, and, turning away, resolved, 'If there remains no other mode of immortalizing myself, I will be content to descend to the grave unhonored and unsung.'"

—Rufus B. Sage, 1841



INDEPENDENCE ROCK (WYOMING)

"IN THE MORNING we drove the horse waggon to Independence Rock & staid there some 2 or 3 hours examining names. . . . I was not certain I knew any of the persons put down though there were many familiar."

—Lucy Rutledge Cook, 1852



MITCHELL PASS (NEBRASKA)

"In the distance . . . rolled up the gigantic form of Scott's Bluff, towering in marble whiteness toward heaven. . . . seemingly interminable, dome and spire, and tower, and wall, and battlement, and cedar trees scattered over the whole like living moving men."

— Israel S. P. Lord, 1849



UTAH SALT FLATS

"The sun shone very hot and the ground being encrusted over with salt, it made our eyes ache from the reflection. The thermometer stood during the day at one hundred and forty degrees and not a sprig of anything could be seen on the desert."

— E. M. Primes, 1850

"ABOUT 5 O'CLOCK we saw McClosky coming back with some water, and those who could raised a shout. My tongue was swollen and clove to the roof of my mouth so that I could not speak."

— Edwin Hillyer, 1849



DONNER LAKE (CALIFORNIA)

“WE CAME DOWN TO THE LAKE to some cabins that had been built by some emigrants last fall. They were overtaken in the snow. There were eighty of them in number, and only thirty of them that lived. The rest of them starved to death.” —*Nathaniel V. Jones, 1847*



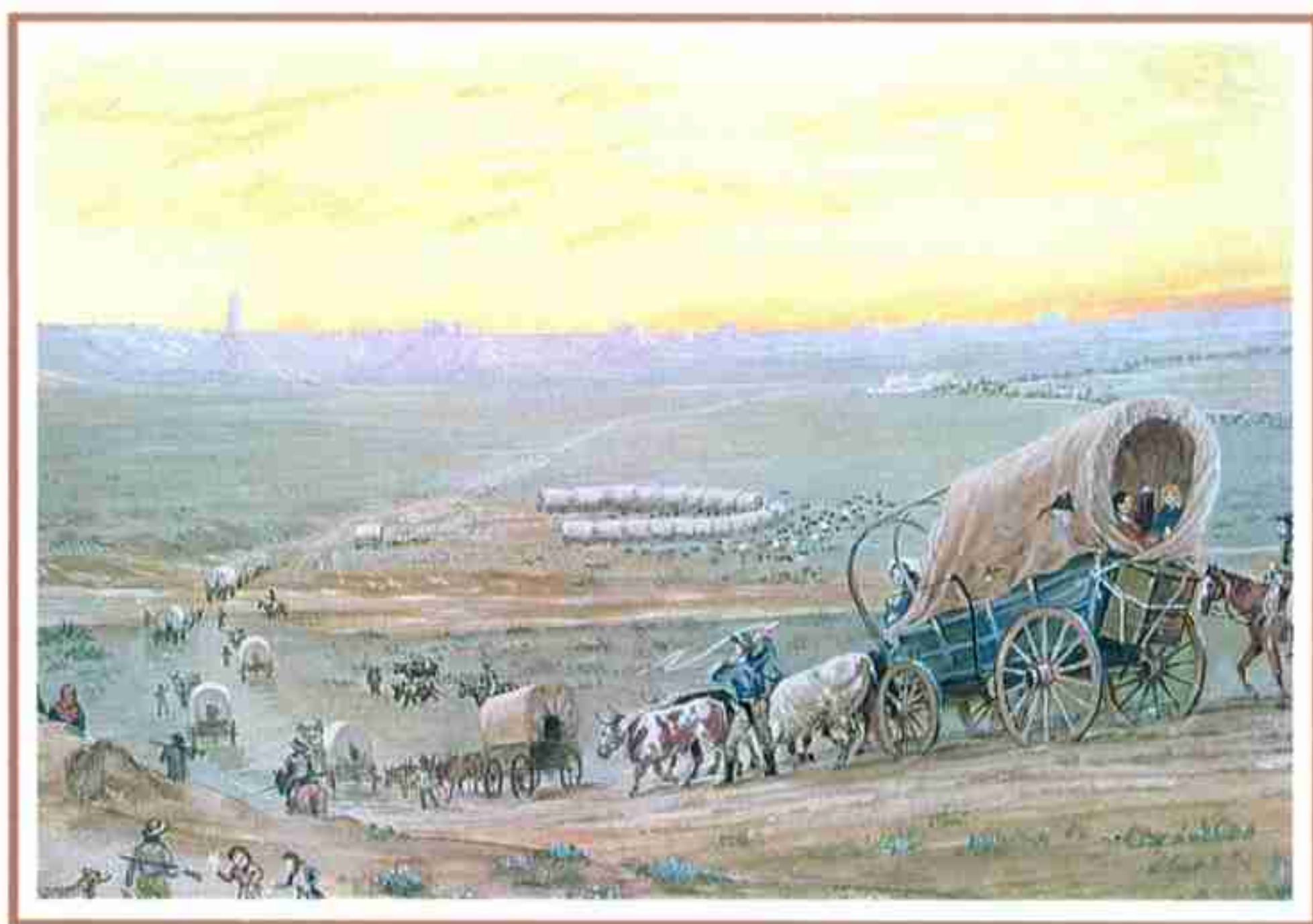
(Continued from page 41) indolent" for want of exercise and arrived at his destination "fully prepared to be a loafer, if he was not one before he started."

The rush for California inspired bombastic fantasies as well as bloated claims. A Missouri inventor built a "wind wagon" equipped with sails designed to whisk the traveler across the plains at 15 miles an hour. Then one Rufus Porter, founder of *Scientific American* magazine, advertised in 1849 that the best way to California would be aboard his Aerial Transport, a cigar-shaped, steam-powered conveyance slung from a thousand-foot-long balloon. Porter vowed that the machine would take 50 to 100 passengers from New York to California at speeds exceeding 60 miles an hour. The minimum fare: \$50, wines included. Travel time: three days. Fortunately for the distant future of aviation, Porter's pipe dream never got off the ground.

So the reality of overland travel was reduced to this: If you were trailing to California, you'd best round up an outfit—a canvas-covered wagon and a team of oxen, mules, or horses. Oxen, the strongest of the three, were

generally preferred. As for the wagon, a typical one in the 1840s consisted of a hardwood box about 11 feet long, with bows for the cover topping out 5 feet above the wagon bed. Such a rig could carry a load weighing from 1,600 to 2,000 pounds, depending on the number and condition of the draft animals up front.

But most of the emigrants disregarded the obvious limitations of their outfits and hopelessly overloaded them with food and belongings. As a result a winding junkyard soon defined the way west, especially along the Platte,



"APPROACHING CHIMNEY ROCK" (NEBRASKA)

in the deserts, and up the tortured canyons of the High Sierra. The litter included just about everything: bacon, beans, anvils, axes, cookstoves, harnesses, claw-footed tables, and bureaus of carved oak.

The worst of it fell along the Forty-Mile Desert in Nevada between the Humboldt Sink and the Carson River. Here thousands of abandoned wagons and the stink of dead and dying draft animals, done in by alkali poisoning and stress, greeted the traveler well into the 1850s.

A number of years ago I paid a visit to the Forty-Mile Desert with Ron Anglin, a self-taught trails historian working at the time for the U.S. Fish and Wildlife Service as manager of the nearby Stillwater National Wildlife Refuge. We drove north out of Fallon, Nevada, into the desert in a 4x4 vehicle, and Anglin showed me the sinks where loose sand and evaporation work a disappearing act on the Humboldt and Carson Rivers. The trail came this way, west by southwest, heading for water and the mountains.

"It was a bitch if they got here in August," Anglin said, "and most of them did. The wagons were dried out and brittle, the animals worn out, the wheels loose. And then having to cross this."

We drove on to a slick of fetid water called Salt Creek. In his 1849 diary, one James A. Pritchard had proclaimed the slough to be "a most disagreeable place." The water, he went on, "is said to kill stock instantly."

CROSSING THE PLAINS

“Great God, I thought, what a sight lay before us. . . . hundreds of teams stretching forward like a great Caravan in line on the dark & winding trace leading toward the setting sun.”

—John Clark, 1852

Shading his eyes from the afternoon sun, Anglin said, “Parts of the abandoned wagons were still here in the 1950s—a century later. Then scavengers and museums started hauling them out of here. Can’t find much of anything now. A few nails, a wheel rim maybe. Horseshoes. Bottle shards.”

Graves?

“Can’t find them anymore either—shifting sand,” Anglin said. “But I’ll tell you something. More people probably died on this 40-mile stretch than anywhere else on the trail.”

LONG BEFORE CORPSES and carcasses started piling up on the Forty-Mile Desert, skeptics had fashioned upon the public conscience another wasteland of mythic proportions. It ran from the edge of the tallgrass prairie all the way to the Rocky Mountains, and—thanks to inadequate explorations in 1820 by Maj. Stephen Long—was known to schoolmasters and mapmakers alike as the Great American Desert. The whole territory, it was said, was as bare as the Sahara. If the traveler didn’t starve to death, his animals would. And if both man and beast managed to elude starvation, then how could one possibly elude the savage Indians?

Among the handwringers was the eminent editor of the New York *Daily Tribune*, Horace Greeley—the very same Greeley now widely remembered for advising young men to go west. The catch, however, was that Greeley’s west wasn’t California and Oregon; it was Illinois. In an editorial in July 1843 Greeley scolded the thousand emigrants who had just embarked. Their overland venture, he thundered, had an “aspect of insanity” about it. “There is probably not one among them whose outward circumstances will be improved by this perilous journey.” One supposes Greeley was big enough to eat his own words when, six years later, Peter Burnett, one of the ’43 overlanders, won election as the first governor of California and proceeded to assemble a fortune in gold and real estate.

Not that Greeley and other ink-stained scolds were altogether off the chart, for the trail west *did* entail a perilous journey. That’s where the Elephant came in.

The Elephant. It first entered the emigrant’s vocabulary as a poetic image of the great adventure. In a society just getting acquainted with circuses, an elephant in those days was regarded as something almost as rare as a trip to California. But as travelers began to encounter hardships, they saw that this Elephant wasn’t so poetic after all. It had a mean streak. Diarists, describing some mishap, might write of having felt a brush of the Elephant’s tail.

The cold prairie winds and the hailstorms of April came from the Elephant; the blistered feet, the swollen face from gnats and mosquitoes on the Platte, the busted wheel in the muddy ruts, the broken harness, the runaway mule. And always the premonition of even worse to come.

Visit now the journal of W. S. McBride, May 15, 1850, somewhere on the Platte: "I lay here in my tent and hear the merry music and the shuffling of strong men's feet over the turf. I cannot help but feel a melancholy foreboding. . . . Some of us are no doubt doomed never to reach California." And some never did.

Disease was the number one killer: scurvy, smallpox, tick-borne fever, but mostly cholera. From McBride's class of 1850 cholera felled at least 2,000 even before they could reach Fort Laramie. Drownings took a heavy toll at the river crossings, especially on the Platte and on the Green, which swallowed 37 travelers that year.

The Elephant also arranged for death by accidental gunshot, inasmuch as the emigrants tended to be as richly endowed with firearms as they were

INDEPENDENCE ROCK

"We amused ourselves in clambering to the top of it and in reading the inscriptions till the wagons came up. Five miles beyond this we arrived at Devil's Gate, where the Sweet Water bursts through a spur of the mountain."

—*James Bennett, 1850*

inept in the proper handling of them. McBride wrote of a man near Scotts Bluff whose "jaw was shot away when a loaded pistol fired from his breast pocket." And of the travelers in Bidwell's 1841 company the only one to perish on the trail was a young man named Shotwell, who, in the act of drawing a rifle muzzle-first from his wagon, managed to trip its hammer. The eponymous Shotwell "lived about an hour," Bidwell noted, then "died in the full possession of his senses."

By one estimate 20,000 people died on the California Trail between 1841 and 1859—an average of ten graves for every mile. What probably put down most of the unlucky ones or made them susceptible to accidents and disease was a combination of contaminated water, inadequate food, and exhaustion from the constant toil.

Contrary to what the handwringers and later the dime novelists would have had the world believe, Indian trouble trafficked little with the mortality rate on the overland trails. Up until 1849 fewer than 50 emigrant deaths were attributed to Indian attack, and many of those occurred along the pathways to Oregon. But as the numbers of overlanders increased, so did the fatal encounters. By 1860 emigrant casualties probably totaled close to 400. Even more Indians were killed by the *emigrants*.

For the most part, however, interracial trailside encounters in the years

before California entered the Union were likely to be marked by unfounded apprehension among the emigrants and amused curiosity among the tribes (with a bit of livestock rustling thrown in for good measure). Why such proud Plains nations as the Sioux and Cheyenne essentially tolerated the emigrant intrusion still puzzles some scholars. Merrill J. Mattes, the eminent Platte River historian, may have come closest to framing an answer. The tribes in their innocence, Mattes wrote, had no idea that these canvas-topped palefaces might come from a place bursting with restless millions more like them. The Indians, he wrote, “had not yet fully comprehended the fact that the migration was the prelude to their downfall.”

ONE DAY AT INDEPENDENCE ROCK, heading west from Casper, Wyoming, I pulled into that historic site’s parking lot to pay my respects to the trail’s most dramatic repository of emigrant inscriptions (not to mention, I’d noticed on a previous visit, its defacement by contemporary vandals). The rock, a slab of granite resembling a giant tortoiseshell, rises more than a hundred feet above the plains, one long arrow-shot from a meander of the Sweetwater River. The parking lot was empty but for one big five-axle tractor trailer. I supposed that the trucker had parked it here in order to catch a few undisturbed winks. But, no. I was wrong. He was already out of the cab of his truck, scrabbling up the side of the rock.

He was a huge fellow. From the backside he appeared almost obese. He was taking the steep rock slowly, hand over foot, pausing now and then to catch his breath and look around. He saw me watching and waved. Near the top he stopped. He seemed to be studying something between his feet, the scratched relic of some emigrant’s name, perhaps, an antique date engraved in the granite. Suddenly his hand reached down, fingertips brushing the inscription. Then he moved on and was over the rim, out of sight.

Alone now at the base of the rock, I tried to imagine those wagoning times before five-axle trucks and paved-over parking lots; tried to picture Broken Hand Fitzpatrick caching his furs here on the Fourth of July in 1824 and maybe giving the monolith its first scratch; then Bidwell arriving in 1841, just one day too late to celebrate the Independence anniversary; and finally Lansford Hastings, one year later, lingering here to chisel his name into the rock while his traveling companions pressed ahead.

It was often said of the ambitious Hastings that he was a man on the make. What he wanted was a name for himself among the new Californians. Toward that end Hastings advocated a shortcut that would save hundreds of miles and weeks of travel between Fort Bridger and the Humboldt River. Alas, Hastings Cutoff was not to be what its promoter promised. In 1846 the ill-fated Donner-Reed party took Hastings’ advice and got bogged down in the Great Salt Lake Desert. Had they followed the main trail instead, they might have crossed the High Sierra before a blizzard



“INDEPENDENCE ROCK” (WYOMING)

could bury more than 30 of them and turn the survivors into cannibals.

In any event, before all that happened, there was Hastings carving his name into the rock. Whereupon (the story goes) a band of sporting Sioux trotted up and took Hastings as their captive but, thinking better of it, soon returned him to his company in exchange for a twist or two of tobacco. If only the Sioux had kept Lansford Hastings or killed him, the subsequent history of the trail might have been favorably rewritten. No Hastings, no Hastings Cutoff. No cutoff, no disastrous delay for the Donner-Reed party.

I was turning back to my car when I saw the trucker sliding down the side of the rock on his fanny, feet first, using the palms of his hands for brakes. At the bottom he brushed himself off, snapped his suspenders, and pronounced his adventure well worth the effort. Trucking west, he said, almost always got him thinking about the wagon days and all the people crossing over to California. "I just have to get out now and then and get into a place like this," he said. "If you know what went on here, you got

to get out and touch it."

I guess I knew what the big man was getting at that day. I'd felt it from the river landing at Independence, Missouri, across the undulant green hills of eastern Kansas to the place where Susan Hail, overland class of 1852, lies buried under a gravestone with a Platte River view. Felt it for certain along the Platte—the Seacoast of Nebraska, where the river in flood sometimes spread wide enough to give the entire valley a curious inland ocean look.

Up the Platte one is duty-

bound to salute the great eroded sandstone landmarks that stand like beacons for the westering traveler—Courthouse and Jail Rocks, Chimney Rock, and Scotts Bluff. The forty-niner Niles Searls thought that Scotts Bluff bore "a good resemblance to an ancient castle" with "stinted trees upon its brow looking like armed men on the battlement." Looked that way to me too, 150 years later.

Onward. On past Fort Laramie into sagebrush country, on past Devils Gate where the Sweetwater has carved an abyss in the ledge rock, on under clouds scudding low off the Ferris Mountains and the gritty electric smell of rain against dust.

South Pass at last, the halfway point at the Great Divide, though you'd hardly know it, the contours here so soft and easy. Down now to the rivers, the Big Sandy and the Green and Blacks Fork where Jim Bridger, the mountain man, built a stockade for resupplying the emigrants.

I'm in a mood, just for the hell of it, to skip Fort Hall up on the Snake and head west from Bridger's fort, following the Mormon way across the Wasatch Range to the Great Salt Lake, and take Hastings Cutoff across the desert. Let's go.

Not so fast. Beyond the city the Saints built there is a sign beside the road, our latter-day trail, warning the traveler that he is about to cross



"MARSHALL FINDS GOLD" (CALIFORNIA)

THE MOTHER LODE

“Our journey is done, and we hardly know what to do with ourselves. . . . There will be no more Indian alarms, no more stampedes, no more pulling, carrying and hauling at wagons. . . . the gold is here sure enough, for we have seen it.” —Isaac J. Wistar, 1849

the Great Salt Lake Desert, where the Donner-Reed party lost valuable time because of the soft, muddy flats. “Don’t let it happen to you,” the sign says.

Down we go into the long brown valleys of the Basin and Range country, on track once again with the main line of the old California Trail. A few small patches of snow even now in August clutch at the bald cirques of the East Humboldt Range. Makes you want to get out and go up there and touch them.

The trickling Humboldt River takes us to its sink, and beyond the ghostly Forty-Mile Desert we come at last to the granite escarpment of the High Sierra. Bidwell found his way over the top near Sonora Pass, south of where we’re heading, and the unlucky Donners stumbled north up the Truckee route near Lake Tahoe. We’re for the middle way, up the river and through the pass named for Kit Carson, the frontier scout. The first emigrant wagons came through here in 1848, after which time the Carson became the primary gateway to California. But was it the easiest way? Hear now Niles Searls, from a diary entry on September 30, 1849:

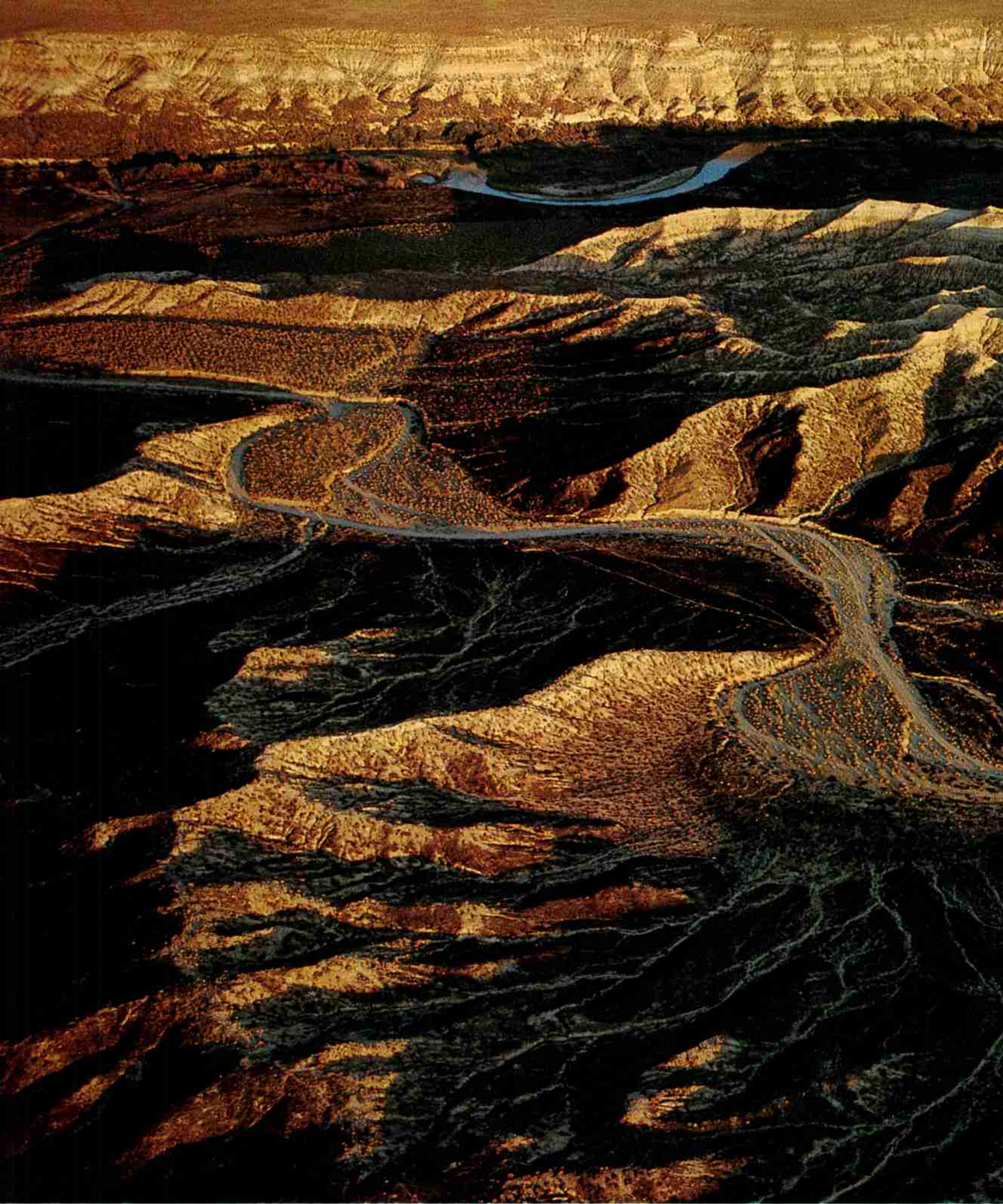
“For eight miles we literally climbed and hauled the wagons by ropes and mules over the jagged rocks which in places were higher than the wagons and perpendicular. . . . rested a day and then spent another in getting to the first Summit and were caught in a storm of sleet by which forty mules were frozen to death.”

It was a different kind of September day, warm and golden, when I got up to the place that Searls describes and touched the top of the Devil’s Ladder. That’s what the emigrants called it then, and I could see why: A precipitous trail still cluttered with broken blocks of granite twitched its way among sugar pines up the eastern lip of Carson Pass. And then they were over the pass, and so was I, and there was one more summit for Niles Searls at Squaw Ridge. One can only imagine his joy standing there: “Far away in the haze the dim outlines of the Sacramento Valley are discernable! We are on the down grade now and our famished animals may pull us through.” They did that too.

And so did you, Niles Searls. You did it the long, hard way from Missouri—you and Bidwell and McBride and all the others. You may have pulled yourselves into California, but by heavens you helped pull California into the United States of America. Now just who was it daft enough to say that it couldn’t be done?

MORE ON OUR WEBSITE

Trials of the trail: Listen to photographer Jim Richardson read from pioneer journals at nationalgeographic.com/ngm/0009.



HUMBOLDT RIVER (NEVADA)

“THIS IS THE POOREST and most worthless country that man ever saw—No man that never saw has any idea what kind of a barren,



worthless, valueless, d--d mean God forsaken country
there is, . . . not God forsaken for He never had any-
thing to do with it.”

—*Dan Carpenter, 1850*



FORTY-MILE DESERT (NEVADA)



THOUSAND SPRINGS VALLEY (NEVADA)

“ONE ONLY HOPE sustains all these unhappy pilgrims, that they will be able to get into California alive.” —*Margaret A. Frink, 1850*



NEAR SOUTH PASS (WYOMING)



JOEL HEMBREE GRAVE (WYOMING)

“HE SLEEPS among the rocks of the West,
as soundly as though chiseled marble was
built above his bones.” —*Matthew C. Field, 1843*



BEYOND WEST PASS, SIERRA NEVADA (CALIFORNIA)



HIGH ROCK CANYON (NEVADA)



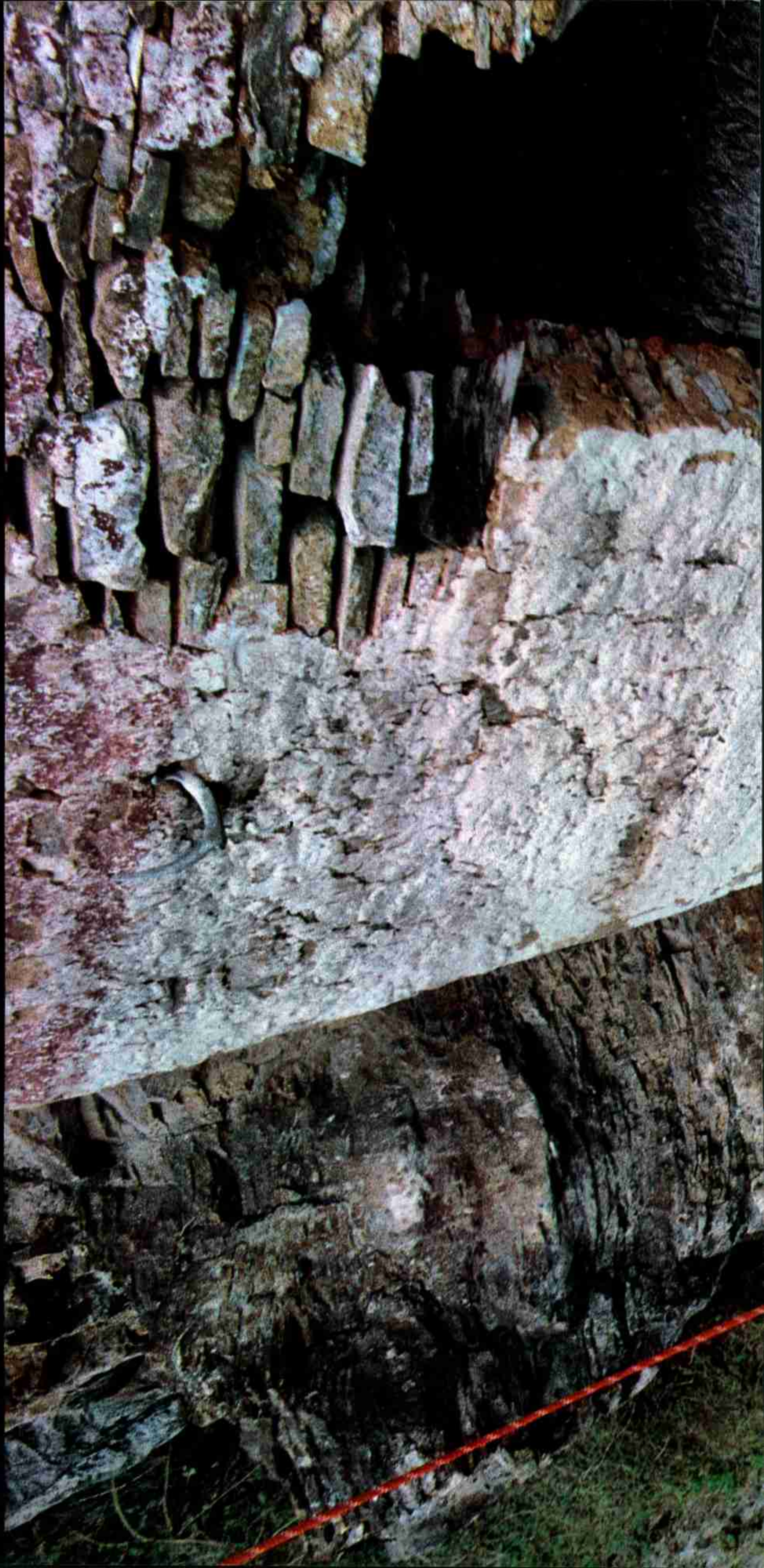
“THE SUMMIT IS CROSSED! We are in California! Far away in the haze the dim outlines of the Sacramento Valley are discernible! We are on the down grade now and our famished animals may pull us through.”

—*Niles Searls*, 1849



TOMB

QUEST FOR THE LOST
OF THE PERUVIAN CLOUD PEOPLE





Dangling outside the White House tomb, which he believes has been untouched for more than 500 years, author Peter Lerche moves in for a closer look at a bundle that likely holds a mummy from a little-known culture. Inca conquerors called this loose alliance of chiefdoms the Chachapoya, or Cloud People. Famed among the Inca and later the Spanish as warriors, weavers, and shamans, they built hill-top cities, terraced fields, and cliff-side tombs on the mist-shrouded eastern slopes of the Andes.

BY PETER LERCHE

PHOTOGRAPHS BY GORDON WILTSIE

RECTANGULAR AS A SHOEBOX, the mud-and-stone tomb could not be more austere. A few logs serve as its roof; a squared opening is cut into one side. From a distance the most interesting thing about this centuries-old crypt is its location: a ledge two-thirds of the way up a thousand-foot cliff in the Peruvian cloud forest.

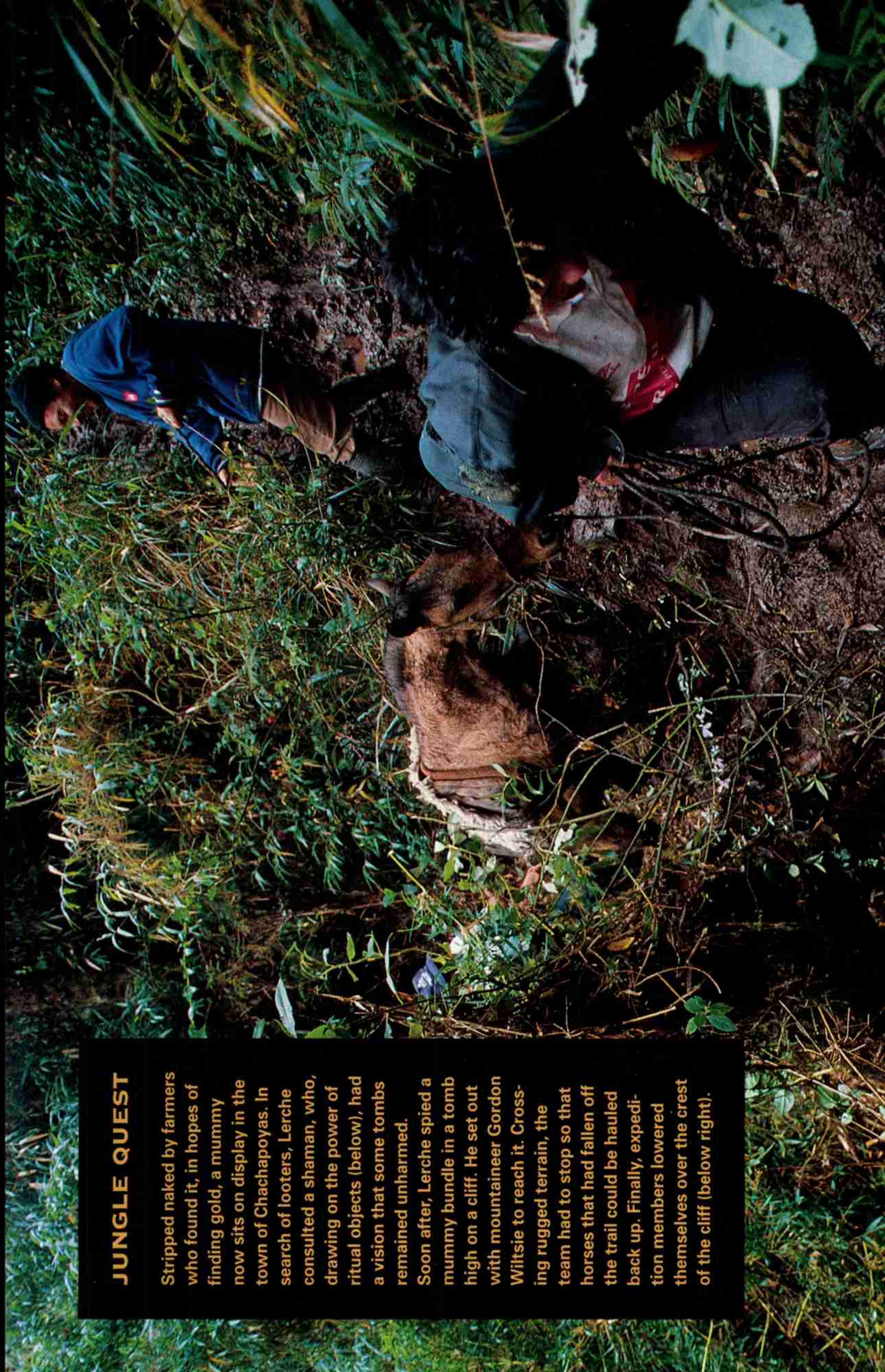
Now, viewed from the end of a thin climbing rope—and after a four-day trek through dense forests and rocky mountain passes—the tomb lies tantalizingly close. Just inside the opening, a shaft of sunlight illuminates two basket-like bundles. They look to be mummy coffins. And they are undisturbed.

This funeral house, or *chullpa*, is one of

JUNGLE QUEST

Stripped naked by farmers who found it, in hopes of finding gold, a mummy now sits on display in the town of Chachapoyas. In search of looters, Lerche consulted a shaman, who, drawing on the power of ritual objects (below), had a vision that some tombs remained unharmed.

Soon after, Lerche spied a mummy bundle in a tomb high on a cliff. He set out with mountaineer Gordon Wiltsie to reach it. Crossing rugged terrain, the team had to stop so that horses that had fallen off the trail could be hauled back up. Finally, expedition members lowered themselves over the crest of the cliff (below right).



the few I have seen unlotted in 20 years of studying the Chachapoya, an ancient culture that built thousands of tombs in this region on the eastern slopes of the Andes.

Exciting as the sight is, it is nonetheless frustrating. Our team does not have permits from the Peruvian government to take one step inside the tomb or touch a single item. So we swing from ropes, catching glimpses of its contents. Through the shadows, more artifacts become visible. The long wooden shafts of Chachapoya weapons stand in one corner. A green-tinted, star-shaped object appears to be the metal head of a mace. This is probably a warriors' tomb.

Indeed, one of the few things history tells us about the Chachapoya is their reputation as fierce fighters. This apparently untouched tomb may go a long way toward filling in gaping historical blanks.

Here's what we do know: Beginning about A.D. 800, more than 600 years before the expansion of the Inca Empire, these mysterious people slowly overtook some 10,000 densely forested square miles between the Huallaga and Marañón Rivers. It was probably the Inca

who gave them the name Chachapoya, meaning "people of the clouds." They built hundreds of settlements on mountaintops and ridges, some with as few as 20 of their trademark circular stone structures, others with more than 400. Chachapoya ruins are so plentiful in the thick forests and steep hills that when we push into the region, it is



difficult not to stumble upon some structure built by them. The best known site, Cuelap, high above the Utcubamba River, is one of the most impressive pre-Hispanic settlements in South America.

Here in the *ceja de selva*, eyebrow of the jungle, more than 150 inches of rain can fall in a year. To protect the remains of their respected dead, the Chachapoya chose places where they could count on freedom from standing water: the many cliffs that rise from the forest floor. In the dry microclimate beneath rock overhangs they built platforms of stone or wood; they also placed mummies within natural caves. Some mummies have been found encased in a coating of plasterlike mud, stones, and grass, decorated with painted faces. Fortunately for us, this reverence for the dead has preserved a part of the Chachapoya past that otherwise would have been long lost to decay.

IT MAY SEEM STRANGE that a West German-born graduate of the Free University of West Berlin chose to spend his life in Peru studying an extinct culture. I have been fascinated with the Chachapoya since I was 16, poring through books at public libraries for clues to this lost South American society. Unraveling their mystery became my

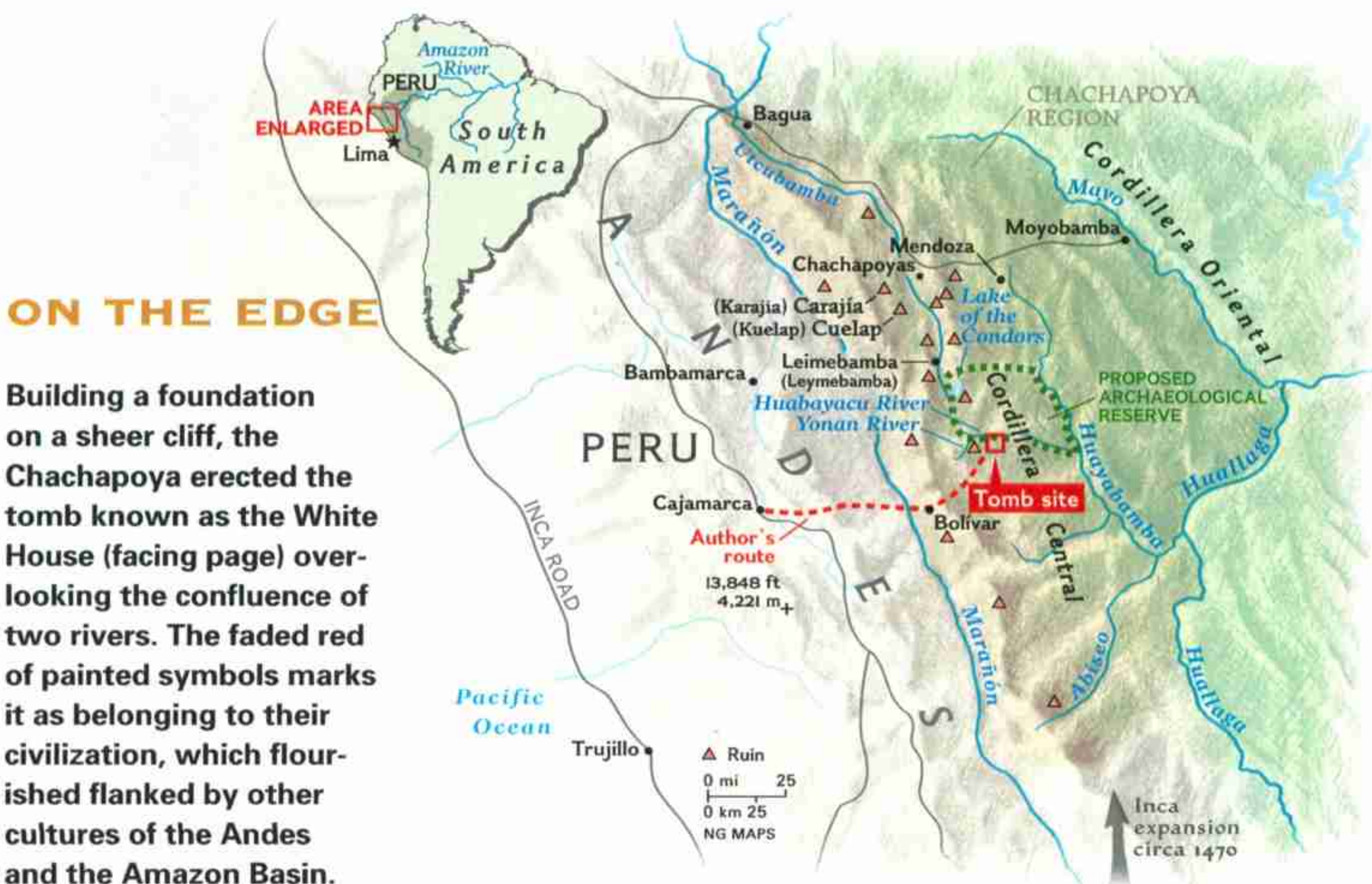
life's work, along with protecting an archaeological heritage that every day is threatened by farmers and ranchers opening new land to crops and pasture. And so 14 years ago I moved to the Andes foothills where the Chachapoya lived and where their burial traditions left some sketches of their customs.

The Chachapoya interred lower-class citizens in common graves with little ceremony. But occupants of the cliff tombs were carefully wrapped in layers of woolen and cotton textiles. They were also surrounded by objects associated with daily life: pottery and weapons.

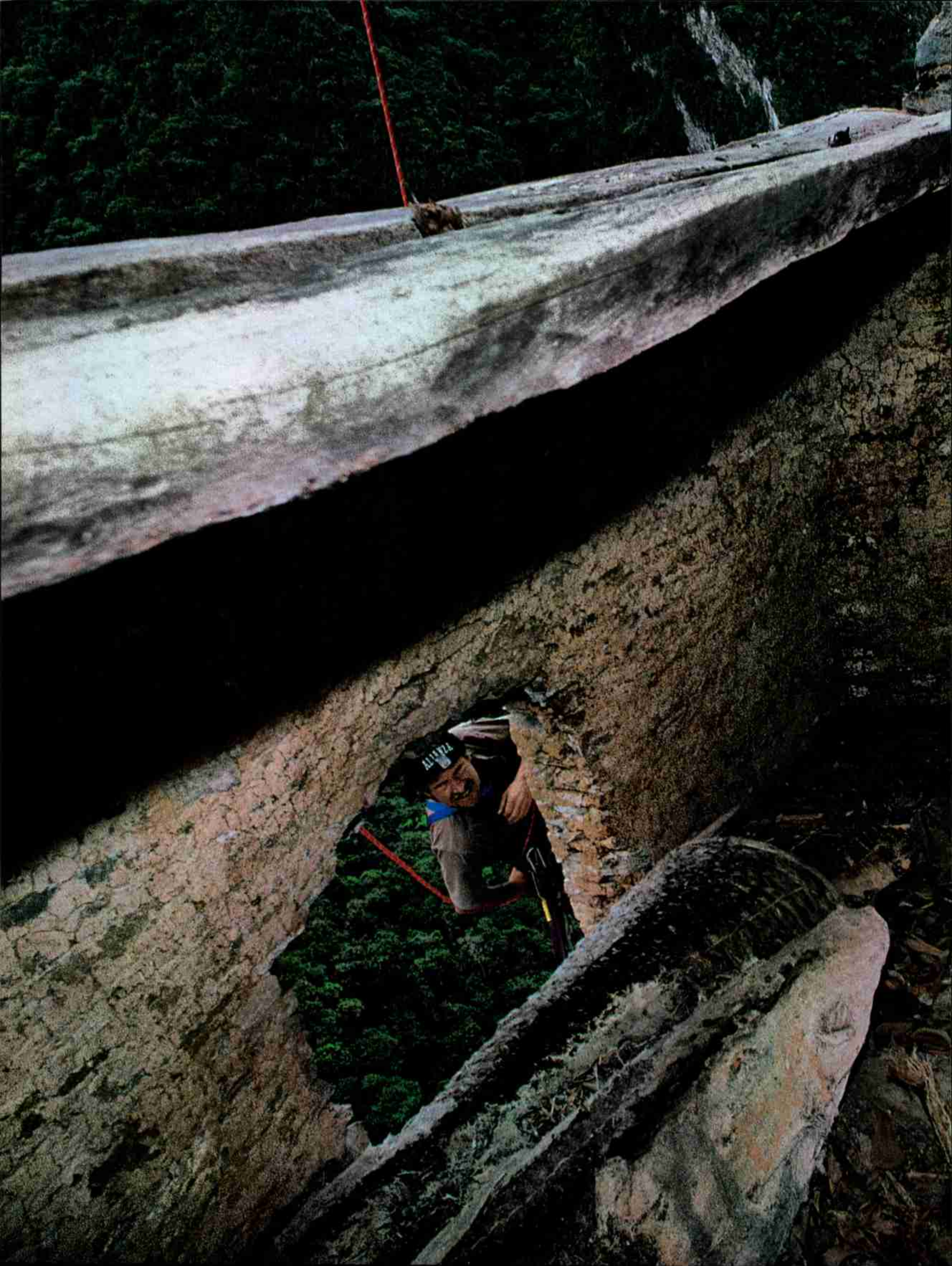
Because the Chachapoya left no written record, scholars have long treasured their burial objects. The trouble is, looters want them too. More often than not, they arrive at burial sites long before archaeologists do.

The Chachapoya developed their culture relatively rapidly, building large towns and fortresses—apparently to protect themselves from each other, since there is little evidence of rival cultures early on in the region.

Around 1470 the Inca arrived, and the Chachapoya were overwhelmed. As part of the Inca policy of subjugation, many residents of Chachapoya settlements were transplanted to distant areas. Traditional Chachapoya burial rituals, including the building of tombs, persisted for a time. But because the conquering







AIRBORNE ARCHAEOLOGY Peering through an opening left for ventilation, Lerche sees enough of the White House to convince him that the tomb has not been looted. Mummy coffins of staves are still bound with rope, and a thick blanket of



leaves covers the floor. In a corner the wooden shafts of a mace and a spear lean against a partial roof. Since he had no permit to excavate, Lerche left the tomb untouched, but he plans to return to secure it from theft and to investigate further.

Inca often preempted tombs for their own use, many contain not only typical Chachapoya crafts but Inca artifacts as well.

IN APRIL 1997 Peru's archaeological community received appalling news from the area surrounding the Lake of the Condors. On a cliff 400 feet above the lake, looters had found and ravaged five chullpas. They chopped many of the more than 200 mummy bundles to pieces. Still, among the leftovers experts have found more than a thousand burial objects, and the government granted archaeologists permission to perform an emergency inventory. Since the site could not be easily protected and researchers feared that many of the ravaged mummies would further deteriorate, the tombs' contents were transported to the nearest town, Leimebamba, where they will be displayed in a new museum.

The Lake of the Condors tragedy generated great interest in the Chachapoya culture. In 1998 Peru's National Institute of Culture granted permits for a photographic survey of funeral sites in the valley of the Huabayacu River, southeast of Lake of the Condors. Sadly, our expedition documented one looted tomb after another, 54 in all. Not until later did I spot one promising prospect in the same part of the eastern Andes foothills. Some 700 feet up a sheer cliff, the opening to a hut-like chullpa offered a glimpse of an intact mummy coffin. The tomb's plastered walls outlined against the rocky cliff quickly earned the chullpa its nickname, the White House.

There was only one way to find out if the tomb was unlooted, and that was to somehow get up to it. Or down to it, as it turned out. Like most Chachapoya cliff tombs, this one was built under a large overhang.

As a National Geographic team—consisting of photographer Gordon Wiltsie, video cameraman John Catto, three assistants, and me—set out for the site, everyone knew that the only possible access route was to climb onto the cliff over the tomb, then rappel down for a look. Later three local officials would join us to witness the tomb's condition and our careful treatment of the site.

After a quick hello at the airport in the city of Cajamarca, the team boarded a minivan and held on tight as our driver headed toward

the mountains. It was a typical ride along unpaved Peruvian roads, bucking up and down on rolling terrain—until the van came to the edge of a vast, deep valley.

"Now what?" asked Gordon.

The driver hit the gas—gently—and the next several hours was spent creeping back and forth down a dirt switchback road. When the van finally bottomed out, we'd descended 7,500 feet into the Marañón gorge.

"Now what?" asked Gordon.

The driver hit the gas—hard—and drove up the other side, this time 10,000 feet of virtually vertical switchbacks.

A 12-hour day had yielded just 55 miles as the crow flies. Not far from the town of Bolívar we spent the night with the Siccha family, old friends who own a farm there.

The van would go no farther. From here on was horse country. Early the next morning, accompanied by seven horsemen from the Siccha farm, our group inched upward another thousand feet to the *jalca*, grasslands covering the upper slopes of the Andes in northern Peru. A wet mist shrouded the ancient trail, nearly invisible to outsiders but familiar as Main Street to the horsemen.

Their guidance was essential. At times the mist was so thick that visibility dropped to two or three yards. The heavy air absorbed the sound of the horses' hooves and muffled the soft brush of tall grass against their legs. Our group rode until dark, then set up camp.

DAY THREE dawned beautiful. The trail was clear even to flatlanders, but the grasslands lasted only a few more miles. As we descended, the cloud forest appeared before us, and the sound of the horsemen's flying machetes filtered through the trees. The trail was still there, they insisted. It was merely overgrown.

Thick vines snapped against our faces. Newly sliced branches tore at our clothing. We soon gave up trying to swat away the insects that buzzed incessantly around our sweaty faces.

Then the horses started to disappear.

One moment I was stumbling along, staring ahead at the rump of a lumbering horse, and then it was gone. It simply disappeared into the thick brush to the right. A moment later came the sickening sound of a wild

LOST CITY

Newly convinced that serving as guides will bring them more money, some local farmers have turned away from looting. One farmer (bottom) cuts a trail to ruins he stumbled



upon on a peak above the White House. The finds include a circular foundation (right) and a stone head. Latter-day pioneers like this farmer are settling areas lost to the forest since the time of the Chachapoya, bringing new sites to light but exposing them to danger.





tumble, the clatter of hooves, a terrified wail.

No one had noticed that the earth dropped off on that side of the path. The vegetation obscured it. Obviously the horse had no clue either. Yet there it was, looking up from more than a hundred feet below, confused but miraculously unhurt.

The horsemen were unfazed. With a sigh and a shrug they clambered down the embankment and set to work unloading our camping and rappelling equipment from the horse. Then they gingerly led the creature back up the steep hill.

By the time they had reloaded the horse with its pack, an hour had passed, and off we went again. Until the next horse disappeared. And the next. Four times the poor horses took tumbles. In all four cases the impossibly durable creatures were, within an hour, back at work on the trail.

We spent the night in a log cabin built on the site of Inca ruins along the Yonan River. The next day would be the final leg to base camp, near the chullpa.

ANCIENT URBAN SPRAWL was everywhere. On both sides of the trail evidence of pre-Hispanic settlements peeked through the jungle. A rocky terrace, a low wall, a ruined building. Closer to modern civilization, most Chachapoya settlements have been hopelessly picked over. Farmers use stone from the buildings to erect walls. They raise animals and grow crops on terraces, clearings that once were Chachapoya or Inca fields.

For many years archaeologists assumed there was no history of human habitation in this region. It was too steep, too rainy, too remote. Yet every step deeper into the forest proved those assumptions wrong.

A narrow log bridge over a roaring tributary of the Huabayacu River finally stopped the horses. From this spot, which would become base camp, our group was on its own, carrying ropes, food, cameras, and water.

The cliff was a two-hour walk away. At first sight it was perfectly framed by a break in the forest. And at last, there was the White House,



LONELY CITADEL

Perched on a precipice, Cuelap, the most famous Chachapoya site, occupied a strategic location guarded by massive fortifications against attacks from other Chachapoya and outside raiders. Inside the 65-foot-high wall lie stone sculptures and more than 400 round dwellings—including three restored for tourists.

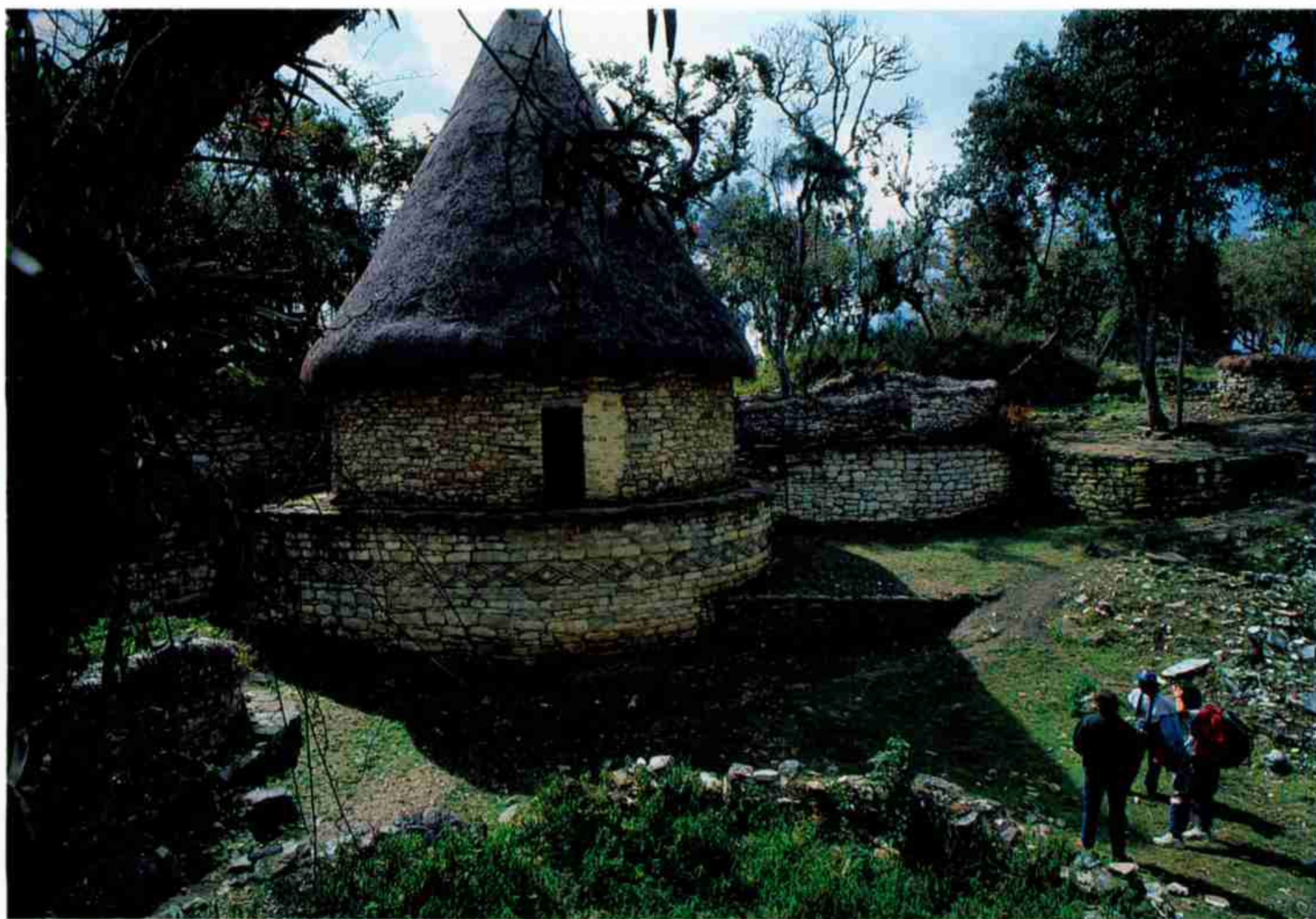


two-thirds of the way up the cliff face. The view confirmed the sheer audacity of those who built that tomb in the sky. Nobody knows for sure how the chullpas were engineered. In some cases the materials may have been carried out to the sites along narrow natural ledges, which the builders then destroyed by chipping after their work was completed. But many of the chullpas must have been built with materials lowered down to the ledges from above—precisely the method we intended to use for gaining access to the site.

Through binoculars it was clear that the visible mummy bundle was exactly where I had seen it before. There had been no recent looting of the site, but the question remained: Had anyone gotten there in the past few centuries?

From the cliff base an assault plan was sketched out. Gordon, John, and I would hack a path around to the right and up a steep incline on one side of the cliff face. From the forest atop the cliff we would hack another path to the large overhanging lip and, from there, drop long ropes for rappelling to the chullpa.

The trek up the brush-choked cliff took several hours. Each step required a good whack of the machete. The White House was hidden





RON WAGTER

from sight by the overhang, so every once in a while the horsemen far below us shouted and gestured to indicate a spot directly above the chullpa.

“Stop!” came the cry from below. Gordon and John fastened the ropes to the trunks of sturdy trees and edged down a steep incline toward the overhang. For all their machete skills, Gordon and John had to be careful. One miscalculation, one clean cut of their rope, and they would get just the briefest glimpse of the chullpa as they plunged past it.

Finally at the edge, John got a good grip on his rope and disappeared. Then it was my turn. Until that moment the only rappelling experience I’d ever had was two nights before, when John and Gordon coached me on a ten-foot boulder near camp. But this was no boulder. Seven hundred feet below spread a carpet of dark green cloud forest.

From some 150 feet beneath the lip, John’s cool voice rose: “It seems that it is intact.”

And so three outsiders found themselves hanging by ropes at the

Looming over Carajía canyon, eight-foot-high sarcophagi, each holding a mummy, stare down from the heights. Chachapoya often placed the remains of their elite on cliff faces to keep them dry and perhaps to enable the dead to watch over the living.

threshold of antiquity. There, up close, was the rustic roof: three thick logs across the top, helping protect the contents of the interior from sunlight and rain. The structure, clearly made of limestone and mud, was roughly 15 feet long, 7 feet wide, and 5 feet high. White clay plastered the exterior, and on its surface the faint remnants of bold red stripes were visible. Red circles were painted on the rock face behind the chullpa, perhaps representing the eyes of ancestors gazing down upon their descendants.

The wooden frame of the opening was charred. Clearly in some long-ago dry season the trees below and the growth clinging to the cliffside were consumed by a raging forest fire. Did those long-ago flames reach the interior of the chullpa?

One look inside provided the answer. Five well-preserved Chachapoya coffins lay on the floor, surrounded by a foot-deep carpet of dead leaves. These were not coffins in a modern sense: They were conical in shape, made of long wooden sticks bound with thick

MORE INFORMATION

AT OUR WEBSITE Photographer Gordon Wiltsie reveals the story behind the pictures at nationalgeographic.com/ngm/0009.

ON TELEVISION Watch “Quest for the Lost Tombs” on **EXPLORER**, Sunday, September 10, at 8 p.m. ET/PT on **CNBC**.



TIME CAPSULE

Salvaged from the chaos of looted tombs, artifacts from Lake of the Condors tell the story of the last years of the Chachapoya. The Inca had imposed their rule and begun replacing mummies of Chachapoya ancestors with their own. The wooden face at left may have looked out from a mummy coffin. A mummified cat, its nose bearing a bone, conveys the ferocity of Chachapoya warriors, who wore metal or perhaps bone ornaments in their noses. A decorated Inca jug stands next to a hybrid—Inca in form but Chachapoya in the plainness of its finish.

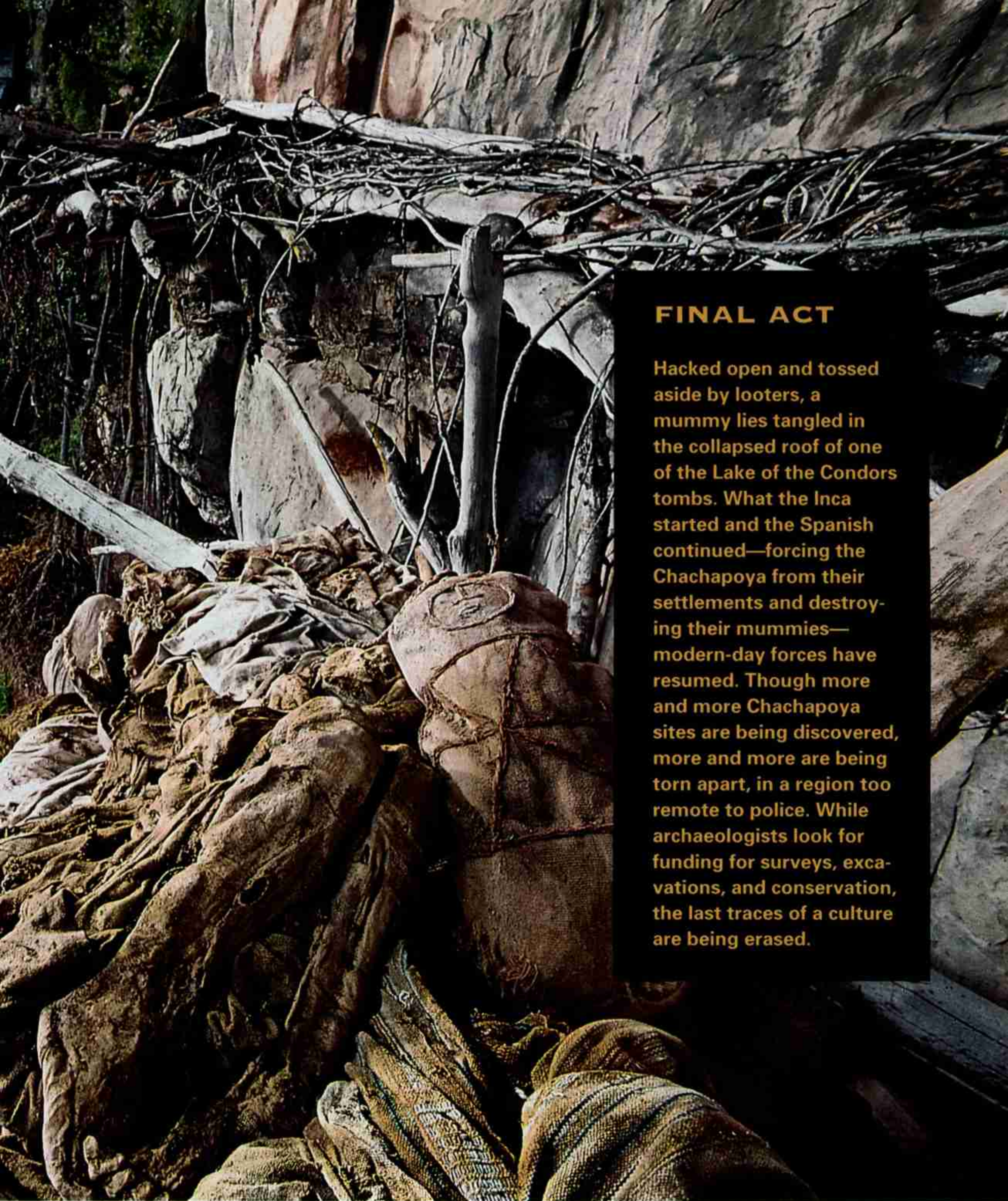


rope. Most likely, hidden inside each of them—wrapped in cloth and curled into an eternal crouch—was a mummified body.

We steadied ourselves outside the chullpa, eyes drinking in the contents. We spent hours perched on the narrow ledge wondering what was under those leaves—probably pottery and household items. Our excitement grew: From

our vantage point nothing seemed to indicate that Inca conquerors had reused the tomb as they had so many others. This could be a rare find indeed.

Although the rainy season was approaching and travel in the region would become more and more difficult, we did all we could to protect the tomb from ambitious looters.



FINAL ACT

Hacked open and tossed aside by looters, a mummy lies tangled in the collapsed roof of one of the Lake of the Condors tombs. What the Inca started and the Spanish continued—forcing the Chachapoya from their settlements and destroying their mummies—modern-day forces have resumed. Though more and more Chachapoya sites are being discovered, more and more are being torn apart, in a region too remote to police. While archaeologists look for funding for surveys, excavations, and conservation, the last traces of a culture are being erased.

RON WAGTER

We impressed upon the local officials as well as farmers in the area how important it was to watch over the site. We made plans to return with officials from the National Institute of Culture to rappel down the cliff again, make an inventory of the artifacts, and take steps to protect them, leaving the dead where they had been placed hundreds of years before.

To ensure that the White House remains intact, we will work with the institute to install fencing over the tomb. The institute, in fact, hopes to have the entire region—540 square miles—declared an archaeological reserve.

In the end, if all goes well, the White House will be left just the way its creators left it: alone on a cliff, open to eternity. □

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WOMEN

OF GRACE

LONG VEILED IN



OBSCURITY, THESE NEPALESE WOMEN REVEAL A LIFE OF ART AND MYTH.



Braced by her beaming mother, little Sabattri joins with friends at an evening performance of theater in their village. Rana Tharu children lean on the women in their extended family, who share responsibility for cooking, childcare, and conserving cultural traditions.



PHOTOGRAPHS BY ERIC VALLI
AND DEBRA KELLNER

T

he older children asleep, Ram Puti, a baby at her breast, sits with a few of her extended family near the evening fire in her small wooden house. Some of the women smoke, and two men repair fishnets in the corner. A debate arises about an arranged marriage that has turned sour.

When it comes to matters of the heart, the lazy laughter of the women transforms into a spiral of opinion that rises with the smoke. One legend says it was a matter of the heart that brought the Tharu people to their isolated homeland in southern Nepal.

Lal Bahadur, an elder in this subgroup called the Rana Tharus, told me that after Moguls invaded India in the 16th century, the Rajputs, members of a high caste in Rajasthan at the time, found themselves in conflict with a Muslim king who wanted to marry a Rajput girl. The women and children fled east across India while their men stayed behind to fight.

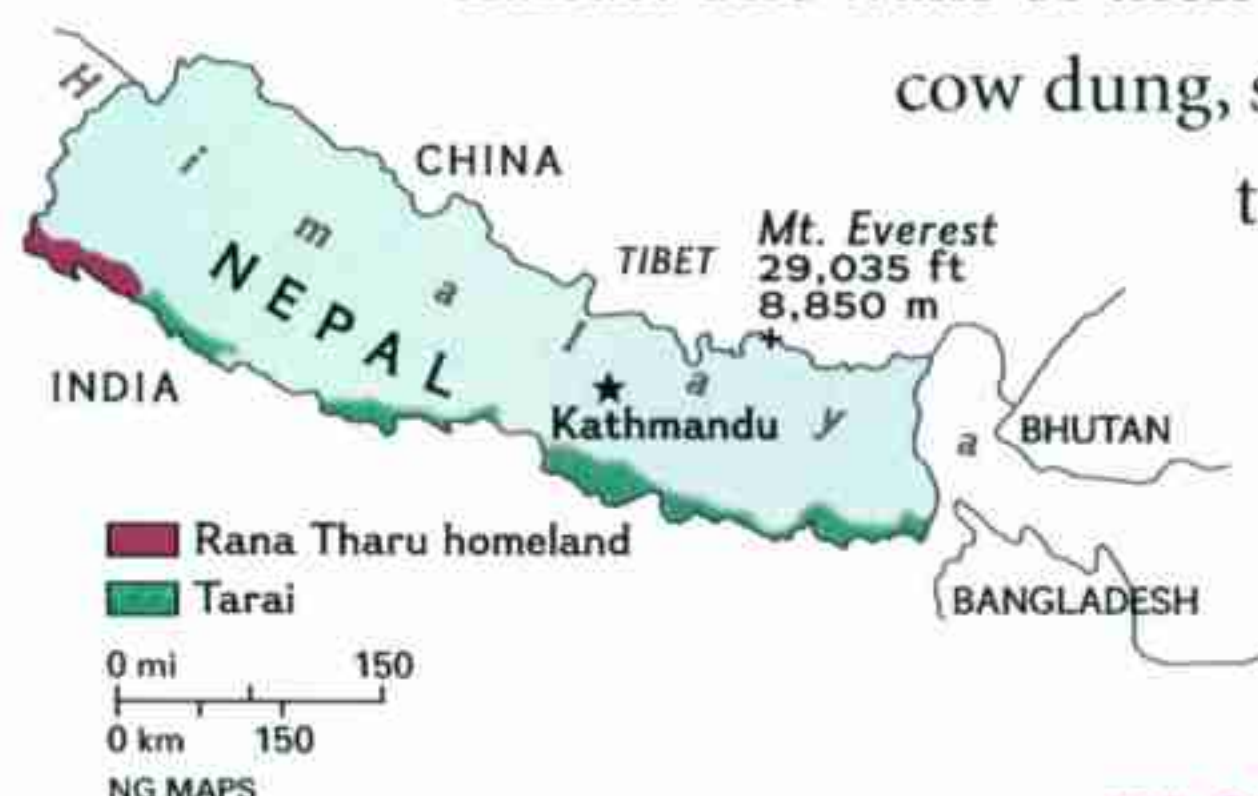
The Tharus, as the refugees came to be known, settled in a forested region called the tarai, which spreads across 550 miles of Himalayan foothills along what is now the Nepal-India border. When word arrived that the Rajput men had all been killed, the women began to marry the slaves who had accompanied them to the tarai.

The Tharus remained separate from the outside world—protected, ironically, by malaria-bearing mosquitoes that prompted outsiders to give the region a wide berth. Though not immune, the Tharus developed some resistance to the deadly disease. They carved their homes from the forest, farmed, and fished in swiftly flowing rivers.

The lives of the Tharus have remained simple for four centuries. Except for a few bicycles, tools, and tractors, I see little around them that they have not made with their hands. The walls of their homes are plastered inside and out with mud and

cow dung, so smooth they look and feel like skin. Their clay containers, their embroidered garments, the fishnets they weave—all the things they touch—are works of art.

What touches the Tharus, however—even in the name of progress—is less benign. Foreigners brought DDT to the tarai in the 1950s.



IN ONE FLUID MOTION Ghumini hauls her net and scoops her catch from a stream that threads through the tarai, a forest area along Nepal's southern edge. Her gear is homegrown: a net woven from hemp, a basket of forest-cut rattan, and a gourd—for carrying fish—plucked from rooftop vines.



Malaria was eradicated, but so too was the barrier to outside encroachment. Borrowing money to pay for goods that outsiders brought them, many Tharus signed documents they could not read—and that ultimately forced them to become tenants on the very land they had owned. Overcutting and poor management of the forestland casts a shadow over the future of the Tharus as well.

Still, the days follow one another. Rain comes in the night. I wake to find the mornings moist and gray. In the evenings I return in the languishing sun to my tent, pitched under a lemon tree. One such evening an old woman named Chanda calls to me and brings me to her house. She wants to thank me for helping her get medicine. Chanda disappears into her garden. I hear the sounds of a scuffle, and she returns with one of her fattest chickens, its feet tied with a rope.

Those who have almost nothing give everything. I do not need the chicken, but Chanda will not listen to my protest and pushes the bird toward my stomach, motioning that it is for eating. For some minutes we push the upside-down chicken back and forth—until it ceases to struggle and closes its eyes.

I must accept something and point to a fishing gourd hanging from a ceiling beam. Chanda raises her eyebrows with suspicion over why I would choose an object with no value in place of a hot meal. As she unties the pot, her daughter Kurowa comes out of the house and tells me to take the pot *and* the chicken. I am happy with the pot. I squeeze Chanda's hand and leave mother and daughter standing with the chicken.

During my time with the Rana Tharus they never ask when I will leave, but rather when I will come back. They do not see their world

as small or their forest as a dissolving membrane between them and the rest of the world. But when the forest and the culture it nourishes are gone, as is likely one day, something immeasurable will be lost. The day I drive away I peer back through the dusty window of my Jeep and see them waving. The Rana Tharus are like flowers in a time capsule, like grace itself.

—Debra Kellner

MORE ON OUR WEBSITE

Were the Tharus once a matriarchal society? Learn more at nationalgeographic.com/ngm/0009.



“THE SECRET to making strong *kuthias*,” says Anar Kali (above), “is to smooth with very little water and trust the sun to do the rest.” Used to store grains, the jars can last for years. Feminine artistry and colored clay brighten a home’s plaster wall, where a newly sculpted peacock symbolizes good luck.





They carved their homes from the forest,

SHARING a smoke and a short break, two Rana Tharu women (above) relish bidi—cigarettes handmade from a strong local blend. A common pastime, smoking denotes freedom for these strong-willed women, who harvest fields of rice—staple food of their people.

Whirring sickles break morning's hush well before sunrise. The women then stack the golden stalks into large bundles, readying the grain for threshing under the hooves of oxen. To remove dirt and chaff, the women pour the threshed rice past puffs of air from a hand-cranked winnower.



ORDERLY as fields of mustard and wheat that spread beyond their walls, doorless longhouses shelter some 1,500 people in one of several Rana Tharu villages scattered across the western tarai. Extended families of up to 50 people may live in one house, sharing meals, chores, and concern about outsiders who trick them into debt, forcing them to sell tradi-

tional lands that have sustained the Rana Tharus for four centuries. Dividing daily labors, men plow, plant, and weave the nets that women use to fish. In the rain-washed light of summer's monsoon season, one fishing party flutters across a rice field like butterflies on the wing.



farmed, and fished in swiftly flowing rivers.





Beneath bundles of corn and bright garments, women bend to the demands of daily life, shaping clay, cow dung, and grass into portable stoves, called *chulos*. Wood dragged from the forest will fuel these stoves to heat pots of spicy chicken or snails—a flavorful boost to ubiquitous rice.

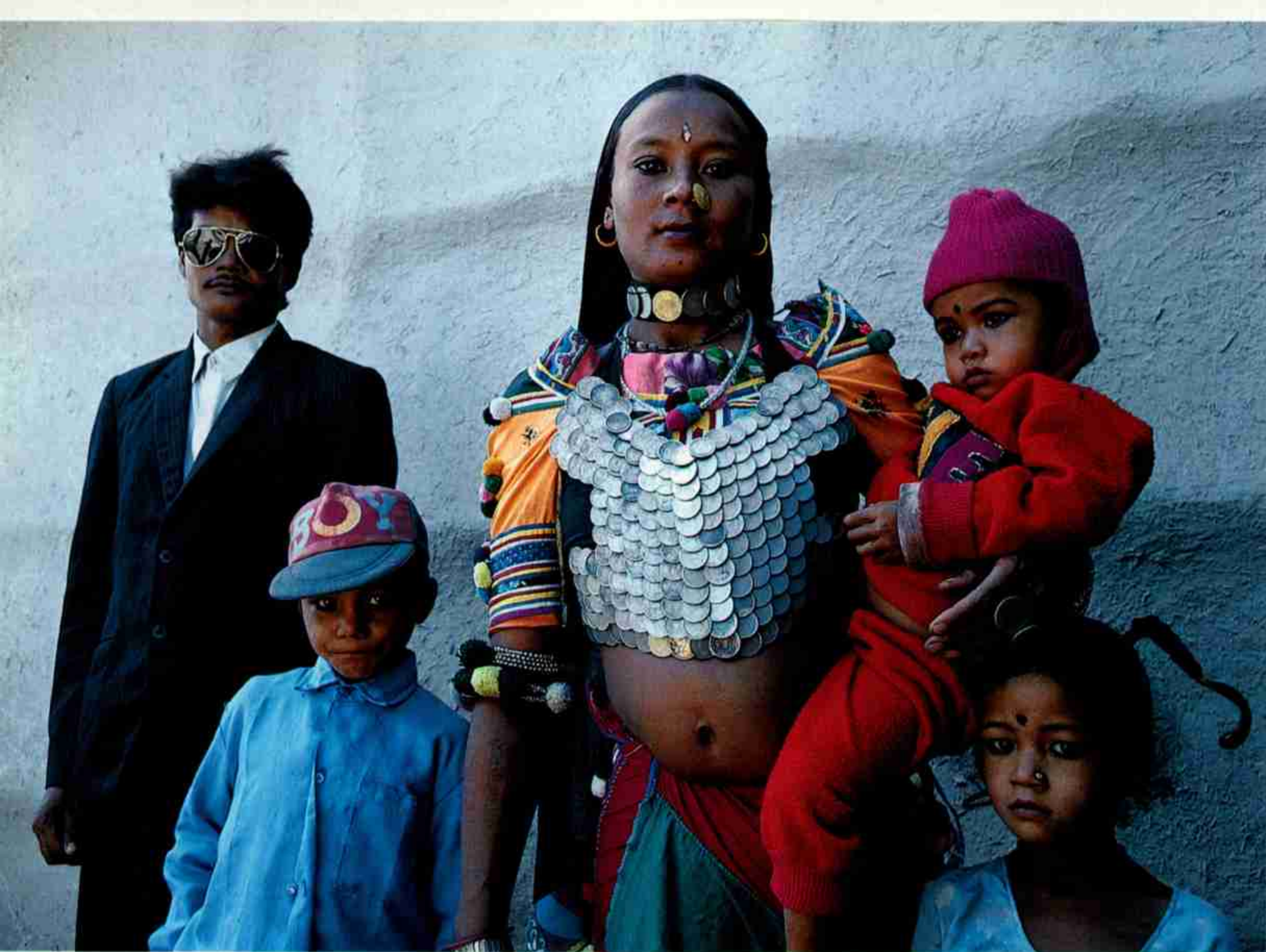


CHANDA. Portrait of hardship and heartbreak, 55-year-old Chanda raised six girls alone after her husband's early death. Her sorrow deepened recently when illness claimed the life of her daughter Kurowa. Yet her adornments defy despair: The vivid hibiscus and 20-rupee note in her ears imply beauty and wealth; a red flash at her hairline recalls her past marriage.





MUNI. Kohl-dark eyes betray the fiery temper of Chanda's niece Muni, whose marriage to a man she does not love was arranged at birth. Unlike most Nepalese women, Rana Tharu women have the right to initiate divorce—provided a new suitor will reimburse the bride price paid by the husband. Now in her 20s, Muni remains married out of loyalty to her family.



I see little around them that they have not

PROUD of her people's descent from upper-caste Rajputs of Rajasthan, Ram Puti (above)—like most Rana Tharu women—clings to tradition, though her husband and children have adopted Western dress. Her breastplate of Indian rupees was passed down from her mother. Braiding hair in a not-so-private bedroom, a young woman wears the intricate dress of Rana Tharu women, called *ghangariya*. Women bargain with merchants for fabric remnants, then get together to share pattern ideas. Expressions of the individuality and skill of the seamstress, no two dresses are alike.



POSSESSED by a spirit of fun, a member of a local comedy team acts out the misfortune of an enslaved Tharu from a neighboring village. A skirt worn as a headdress and a garlic-clove tooth add laughable notes to the often risqué slapstick, called *ragni*. Until recently villagers of all ages would watch into the wee hours of morning. Today, children like Krishna

(below) go to bed and rise early to attend a newly built school, the community's first. With classes taught in Nepali rather than the Rana Tharu dialect, parents worry that formal education will dilute their culture and drive children to seek jobs and lives in a wider world.



made with their hands. All are works of art.





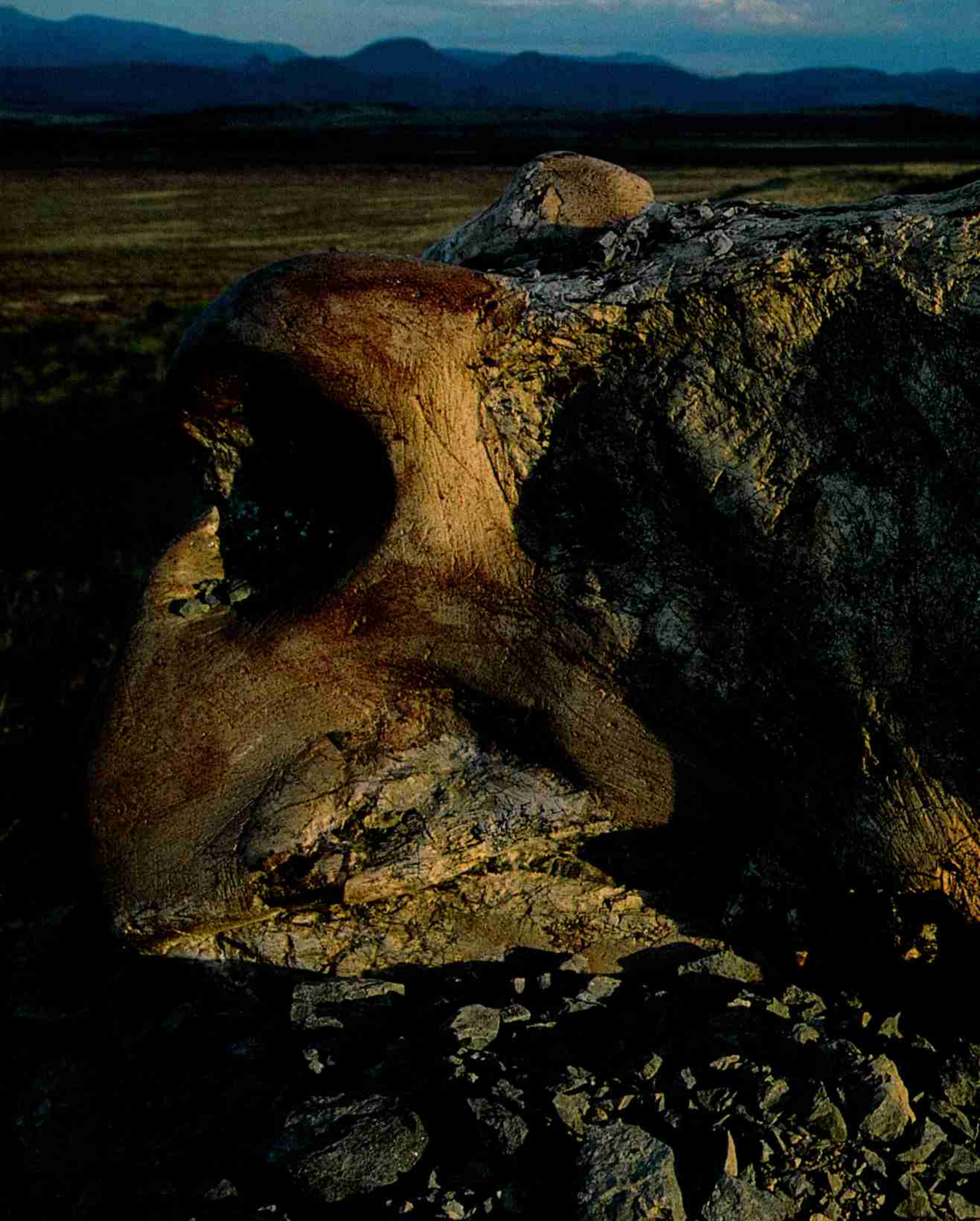
ist drapes a winter dawn as a Rana Tharu woman walks along a log bridge that leads into the tarai forest. Once swarming with malaria-bearing mosquitoes, this marshy region deterred outsiders. Pesticides eventually curbed the threat, and loggers began felling timber. Source of both resentment and opportunity, such changes leave the Rana Tharus an uncertain path ahead.





■ THE RISE OF LIFE ON EARTH

When Life Nearly



Came to an End

THE PERMIAN EXTINCTION

Lost World A quarter of a billion years ago, long before dinosaurs or mammals had evolved, the ten-foot predator *Dinogorgon* hunted floodplains in the heart of today's South Africa. In less than a million years *Dinogorgon* vanished in the greatest mass extinction ever, along with about nine of every ten plant and animal species on the planet. Life has never come closer to being snuffed out.

By HILLEL J. HOFFMANN
NATIONAL GEOGRAPHIC EDITORIAL STAFF

Photographs by JONATHAN BLAIR

WELCOME TO the Black Triangle," said paleobiologist Cindy Looy as our van slowed to a stop in the gentle hills of the northern Czech Republic, a few miles from the German and Polish borders. The Black Triangle gets its name from the coal burned by nearby power plants. Decades of acid rain generated by power-plant emissions have devastated the region's ecosystems. Yet the treeless hills looked healthy and green.

I tried to hide my surprise. For months I'd been on the trail of the greatest natural disaster in Earth's history. About 250 million years ago, at the end of the Permian period, something killed some 90 percent of the planet's species. Less than 5 percent of the animal species in the seas survived. On land less than a third of the large animal species made it. Nearly all the trees died. Looy had told me that the Black Triangle was the best place today to see what the world would have looked like after the Permian extinction. This didn't look like apocalypse.

We saw the first signs of death as we walked into the hills—hundreds of fallen timbers lay hidden in the undergrowth. A forest once grew here. Half a mile uphill we found the trunks of a stand of spruce, killed by acid rain. No birds called, no insects hummed. The only sound was the wind through the acid-tolerant weeds.

"The forest that grew here a few decades ago contained dozens of species of plants," said Looy. "Now there are only a few grassy species."

Looy picked up a spruce cone. Pollen from the trees around us might be preserved inside. She believes that the Permian extinction was caused by acid rain following a massive release of volcanic gases. She wants to compare tree pollen from a modern forest killed by acid rain with fossil pollen found in Permian rocks.

Like a homicide detective at a crime scene, Looy sealed the cone in a plastic bag for later lab work. "You could say we're working on the greatest murder mystery of all time," she said.

Looy is one of many scientists trying to identify the killer responsible for the largest of the many mass extinctions that have struck the planet. The most famous die-off ended the reign of the dinosaurs 65 million years ago between the Cretaceous and Tertiary periods. Most researchers consider that case closed. Rocks of that age contain traces of an asteroid that struck Earth, generating catastrophic events from global wildfires to climate change. But the Permian detectives are faced with a host of suspects and not enough evidence to convict any of them.

To understand this extinction, I wanted first to get a sense of its scale. That's difficult—sediments containing fossils from the end of the Permian are rare and often inaccessible. One site that preserves the extinction's victims lies about a half day's drive inland from Cape Town, South Africa, in a scrubland known as the Karoo.

"The Karoo is the kind of place where people fall asleep at the wheel," said Roger Smith, a paleontologist at the South African Museum, as we drove across the treeless land. "But it may be the best place to see the terrestrial realm's transition from the Permian to the Triassic period."

We ascended through sheep-ranching country toward the Lootsberg Pass. The rocks that surrounded us date from the late Permian. For every yard of altitude we gained, we traveled tens of thousands of years forward in time, heading for the Permian's conclusion.

If we had driven here before the extinction, we would have seen animals as abundant and diverse as those of today's Serengeti, except most would have belonged to a group known as synapsids. Often called mammal-like

Millions of years ago
400

300

250

Origin of
dinosaurs

200

100

Permian period

Triassic period

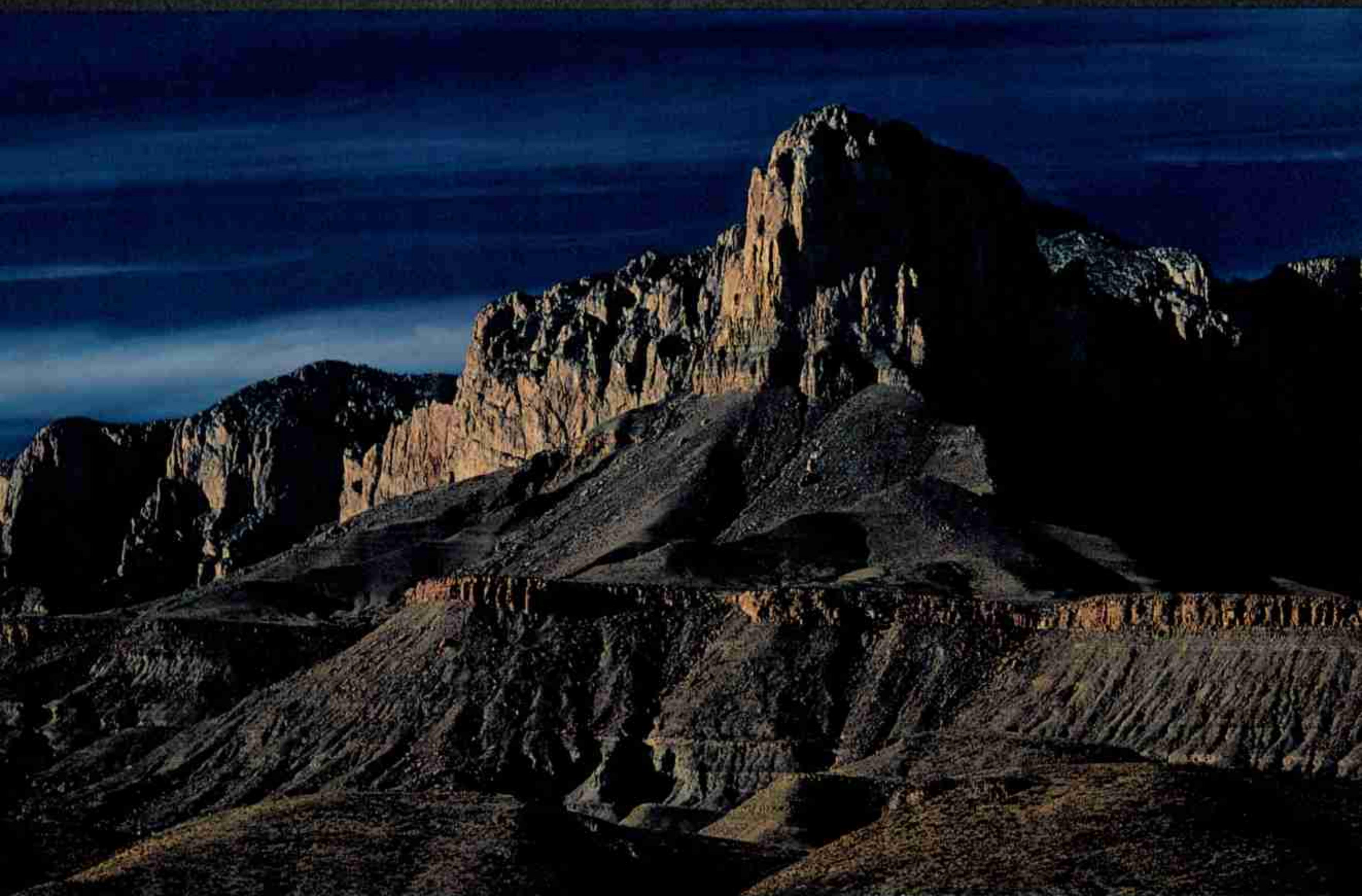
P A L E O Z O I C E R A **Permian extinction** M E S O Z O I C E R A



SOURCE: CHRISTOPHER R. SCOTSE, PALEOMAP PROJECT; RELIEF BY TIBOR TÓTH, ADAPTED FROM ORIGINAL ART BY RALPH SCOTSE

End of an Era

The Permian extinction concluded the Paleozoic era (time line, facing page), the first of life's three great eras since the origin of complex, multicellular organisms. The animals of the Paleozoic may not be as familiar as the creatures that ruled the Mesozoic era, the age of dinosaurs, but the fossil record suggests that Paleozoic ecosystems were as rich as any that followed. The Permian reefs of West Texas, which now form the Guadalupe Mountains (below), were so densely packed with small sea animals that some rocks found there today look like fossilized pasta salad. Before the extinction the continents had drifted together and formed a single landmass called Pangaea (above).



reptiles—they looked like a cross between a dog and a lizard—the synapsids were Earth's first great dynasty of land vertebrates.

"We've found fossils of many kinds of synapsids in these rocks, especially tortoise-beaked dicynodonts, which likely lived in herds and browsed on vegetation along the riverbanks," said Smith. "There were also a lot of smaller grazers and root grubbers, like *Diictodon*, a dachshund-shaped dicynodont that probably dug up roots and shoots. They were preyed upon by gorgonopsians—fleet-footed synapsid carnivores with needle-sharp teeth."

The late Permian rocks we passed as we neared Lootsberg Pass capture the synapsids at the height of their reign. For more than 60 million years they were Earth's dominant land vertebrates, occupying the same ecological niches as their successors, the dinosaurs.

Smith slowed at a switchback, rolled down the window, and pointed to a horizontally

banded cliff. "See that road cut?" he asked. "That's your Permo-Triassic transition zone. Brace yourself, you're about to go through the extinction." The fossils embedded in this road cut suggest that synapsids took a savage hit at the end of the Permian.

A synapsid known as *Lystrosaurus* appears in these sediments. Smith had a skull of the animal in his truck. Its flat face gave it the look of a bulldog with tusks. In the first few yards of the transition zone, only one or two *Lystrosaurus* fossils have been found scattered among all the diverse late Permian animals. Higher up, the diversity suddenly dwindles. Dozens of species of Permian synapsids disappear, leaving *Lystrosaurus* and a few others in early Triassic rocks. Animals were still abundant, but the community they formed was about as species rich as a cornfield.

Plants were also hit by the extinction. Evidence for the scale of damage to the world's

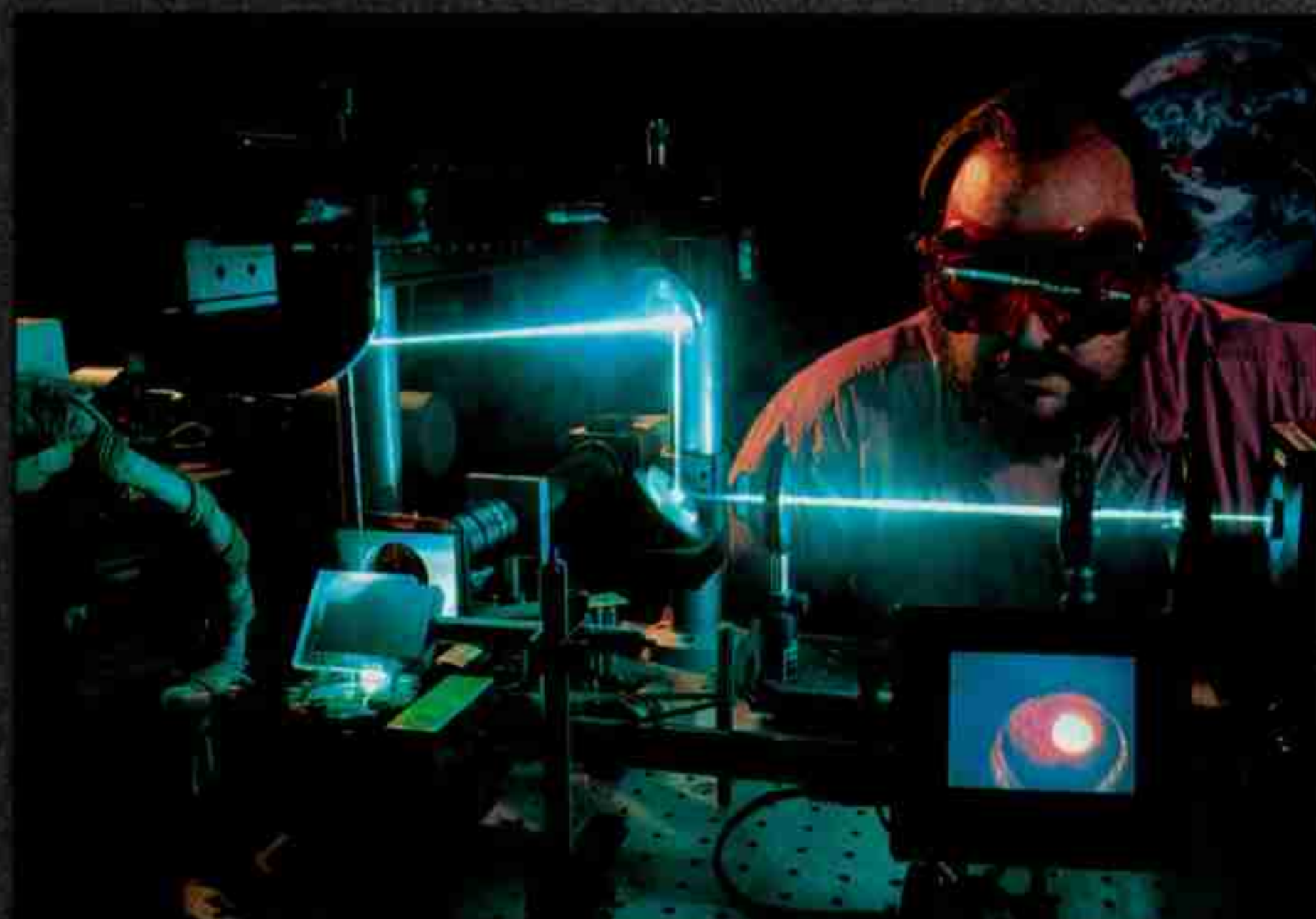
It Came From Below

The list of extinction suspects reads like a disaster-movie lineup: asteroids, sea-level changes, global warming, toxic oceans, volcanoes. The last theory got a boost when geochronologist Paul Renne (below) dated rocks from the end of the Permian and volcanic rocks from the Siberian Traps, the site of the greatest eruptions ever, and found they were the same age. Viscous magma, like Hawaii's

(above right), oozed from cracks in the Earth, covering Siberia. But Renne thinks the real killers were volcanic gases, which caused acid rain and climate change. The aftermath might have looked like acid-damaged forests in the Czech Republic (right).



G. BRAD LEWIS



forests comes from the Italian Alps. I joined a research team led by Henk Visscher of the University of Utrecht at the Butterloch gorge, where exposed fossil beds cover the transition from the Permian to the Triassic. The beds lie high on a cliff, accessible only by climbing piles of debris. I anxiously followed veteran climber Mark Sephton up a slope of loose rocks to a ledge. Sephton used his hammer to chip bits of rock from the layers that chronicle the extinction. Each fragment contains microscopic fossils—pieces of plants and fungi. The lower layers, dating from prior to the extinction, contain lots of pollen, typical of a healthy conifer forest. But in rocks from the Permo-Triassic boundary the pollen is replaced by strands of fossilized fungi—as many as a million segments in some golf-ball-size rocks.

All that fungi in boundary rocks may represent an exploding population of scavengers feasting on an epic meal of dead trees. “We

think it’s a wood-decaying fungus,” says Looy, who works with Visscher. “When a tree dies, it falls. As it decays, fungi grow into it from spores on the ground, decomposing it.”

Visscher and his colleagues have found elevated levels of fungal remains in Permo-Triassic rocks from all over the world. They call it a “fungal spike.” The same rocks yield few tree pollen grains. Visscher’s conclusion: Nearly all the world’s trees died en masse.

On the drive from Butterloch a team member handed me a soft, brown banana—a leftover from lunch. “This is how you can imagine the Permian extinction,” he said. “Rotting biomass.”

“IT’S NOT EASY to kill so many species,” says Doug Erwin, a Smithsonian Institution paleontologist. “It had to be something catastrophic.” Erwin and geologist Samuel Bowring of the Massachusetts Institute of Technology have dated volcanic ash in



Chinese sediments laid down during the extinction. Bowring thinks the extinction took place in as little as 100,000 years—quicker than the click of a camera shutter on a geologic scale of time. Suspects must be capable of killing with staggering swiftness both on land and in the seas. As I spoke with some of the researchers on the killer's trail, I learned how many suspects there are—and how difficult it is to develop a tight case.

An enormous asteroid impact is the prime suspect of Gregory Retallack, a geologist at the University of Oregon. The collision would have sent billions of particles into the atmosphere, he explains. They would have spread around the planet, then rained down on land and sea.

Retallack has discovered tiny quartz crystals

marked with microscopic fractures in rocks from the time of the extinction in Australia and Antarctica. "You need staggering force, many times greater than a nuclear explosion, to create this shocked quartz," said Retallack. "Only an impact could deform it this way." A team of researchers recently found what may be that impact's footprint buried below Australia—a 75-mile-wide crater left by an asteroid more than three miles across.

I asked Retallack what an impact would be like if we had been standing a few hundred miles from ground zero. "You'd feel a shudder," he replied. "Clouds of noxious gases would billow in and block out the sun for months. Temperatures would drop, and corrosive acid snow and rain would fall. After the clouds cleared,

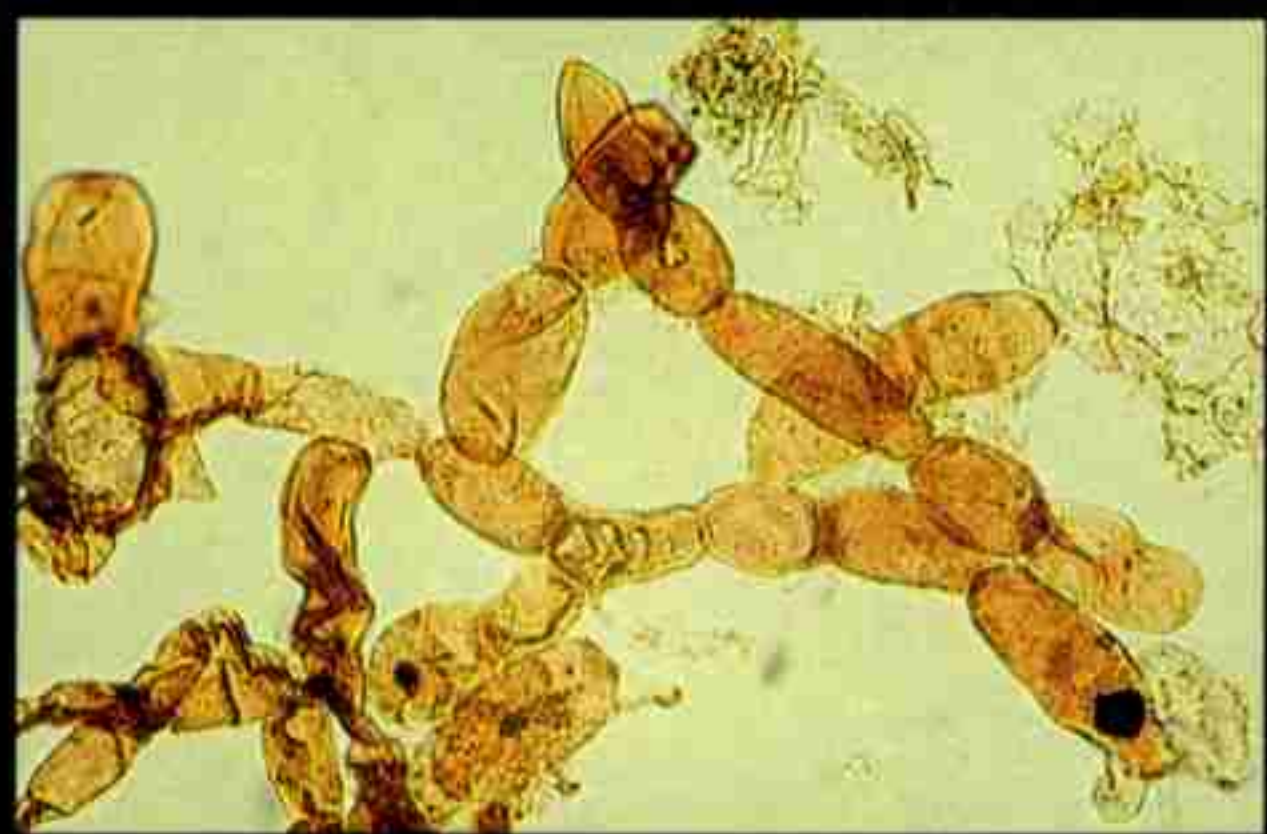


ART BY KAREL HAVLICEK (RIGHT)

On the Beach

Life on Permian reefs (right) grew as varied and abundant as life on reefs today. A few million years later, the extinction claimed about 95 percent of all marine animal species, including many brachiopods (1), bryozoans (2), corals (3), sea lilies (4), ammonoids (5), and trilobites (6). "Seas became scenes of utter desolation," says Doug Erwin of the Smithsonian Institution (left), kneeling by survivors and, in front of the tape, victims. After the extinction, reefs disappear from the fossil record for millions of years, yet some organisms—snails, bivalves, and crustaceans—escaped almost untouched. The fossil echinoid in Erwin's hand, a survivor, is the ancestor of all present-day sea urchins. "Life in a modern tide pool reflects what lived and what died back then," he says.





Feasting on the Victims



On extinction's trail in the Italian Alps, paleontologists Cindy Looy and Mark Sephton climb toward a layer of rock that tells the story of the great dying. Sediments in the cliff are loaded with microscopic fossils of

wood-eating fungal scavengers (left). Fungi have been found in extinction-age rocks from Alaska to Africa, a sign of a world covered with rotting trees. Few plants taller than a shrub remained.



ART BY KAREL HAVLICEK (RIGHT)

Eve of Destruction

In a South African scrubland called the Karoo, paleontologist Roger Smith cleans the footprints of synapsids, creatures that ruled the land when the extinction struck. Gorgonopsians (1) topped the food chain. They stalked herbivores like *Lystrosaurus* (2), *Pareiasaurus* (3), and *Diictodon* (4). The Permian extinction claimed most of them. One of the synapsid lineages that sneaked through led to the earliest mammals.

the atmosphere would be thick with carbon dioxide from fires and decaying matter. CO₂ is a greenhouse gas; it would have contributed to global warming that lasted millions of years.”

The short-term effects alone—cold, darkness, and acid rain—would kill plants and photosynthetic plankton, the base of most food chains. Herbivores would starve, as would the carnivores that fed on the plant-eaters.

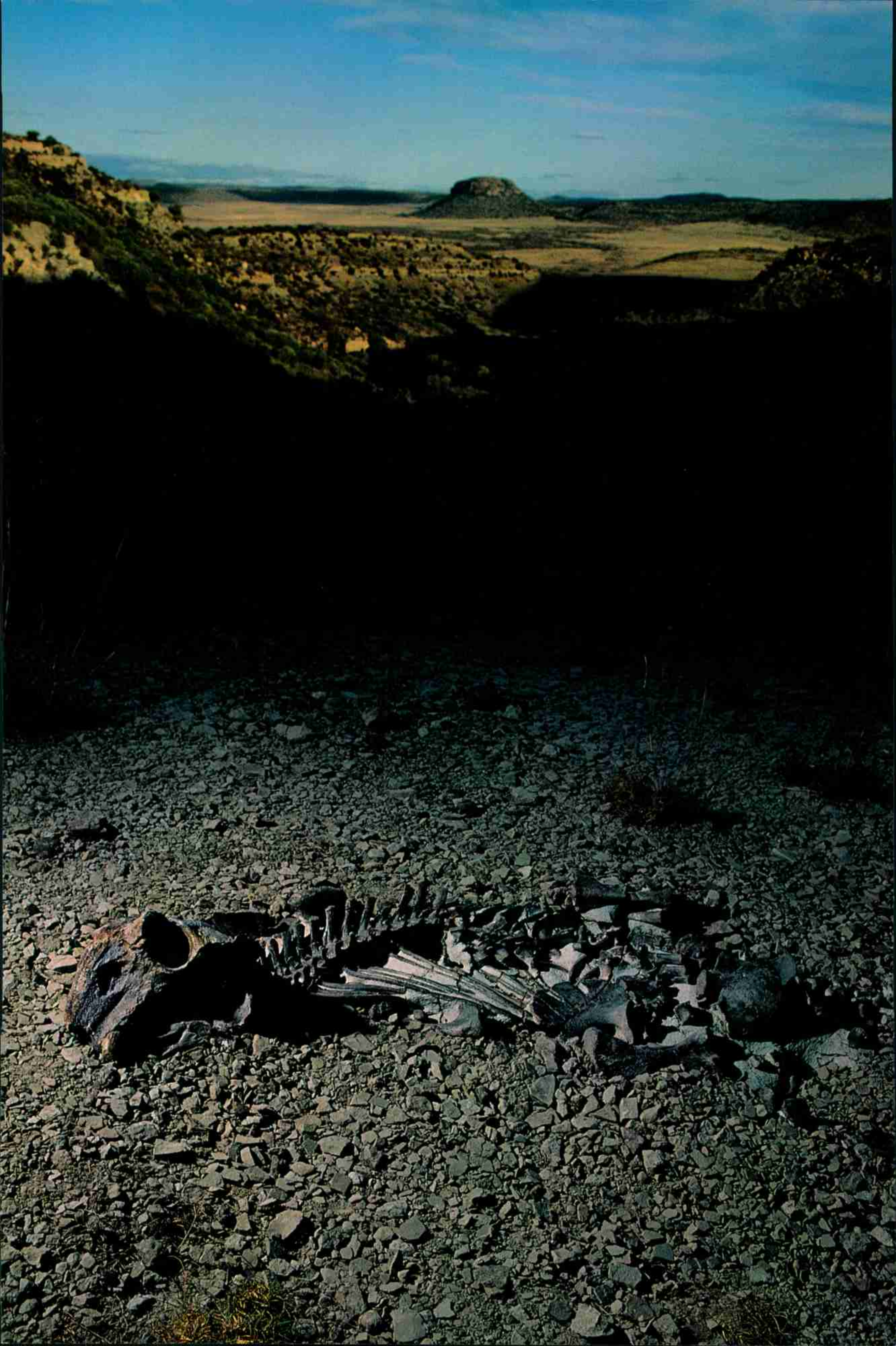
Other Permian detectives suspect the killer oozed up from the sea. For years scientists have known that the deep ocean lacked oxygen in the late Permian. But most life is concentrated in shallow water, in places like reefs. In 1996 English geologists Paul Wignall and Richard Twitchett of the University of Leeds reported the first evidence of oxygen depletion, or anoxia, in rocks that formed under

shallow water at the time of the extinction.

Pollution sometimes turns waters anoxic today in regions that lack good circulation. Local die-offs of marine life can result. But Wignall suspects that the entire ocean may have stagnated in Permian times. What could still the currents that oxygenate the ocean? Perhaps a lack of ice caps during the late Permian led to the stagnation. Normally temperature differences between polar and equatorial waters create convective currents. Without those currents, anoxic water could have built up, spilling into shallow water as sea levels rose and smothering marine life.

Permian oceans also might have been poisoned with CO₂, according to Andrew Knoll, a paleobiologist at Harvard. Oceanic bacteria eat organic matter, producing bicarbonate as a





The Next Era Begins

***Lystrosaurus* survived somehow and flourished in the bleak post-extinction world. Now the chemistry of its teeth is being analyzed for clues about climate conditions. The world, it seems, became warmer. But why? The mystery of the Permian extinction remains unsolved.**

digestive by-product. Without currents, the load of bicarbonate could have grown in the deep ocean. Knoll thinks something big—he's not sure what—disturbed the seas. Bicarbonate-laden water rose from below, he suggests. As it did, it depressurized. Dissolved bicarbonate was released as CO₂, making the seas bubble at times like a glass of soda.

The crisis for marine animals would have started when toxic levels of CO₂ entered the shallows. Fish would have grown lethargic and slowly fallen asleep. "Perhaps the Permian ended with a whimper and not a bang," said Knoll.

Another suspect—a deadly epoch of volcanic eruptions—left a million-square-mile fingerprint in Siberia. Below the town of Norilsk lies a two-and-a-half-mile-thick pile of lava, overgrown by conifers. Geologists call this vast lava field the Siberian Traps. It wasn't produced by one volcano. "Thick, pulsing flows of glowing magma gushed out from numerous broad, flat volcanoes," said geologist Paul Renne of the Berkeley Geochronology Center. "Hundreds of cubic miles spread across Siberia—enough to cover the Earth to a depth of about 20 feet."

For decades scientists have known the Siberian Traps were formed around the time of the Permian extinction. Could the greatest extinction be related to the greatest volcanic eruptions? Renne, an expert at determining the ages of rocks, has been trying to work out the timing of the events. His lab is filled with machines—tangles of high-voltage cables, vacuum lines, and stainless steel—that date rocks by measuring the decay of radioactive isotopes within them. Renne secured chunks of lava from the Siberian Traps and Permo-Triassic boundary rocks from China. He has determined the two events occurred within 100,000 years of each other. Renne doubts that's a coincidence.

But the Siberian Traps volcanoes didn't cause the extinction by swamping the world

with lava. As volcanic gases poured into the skies, they would have generated acid rain, and sulfate molecules would have blocked sunlight and cooled the planet. Glaciation would have reduced the volume of water in the ocean, storing it as ice. Sea level would have dropped, killing marine life in the shallows and severely reducing diversity. Lowering sea level can also release the ocean's methane, which, combined with CO₂ from the eruptions and decaying organic matter, would likely produce greenhouse conditions. "In 1783 a volcano called Laki erupted in Iceland," said Renne. "Within a year global temperature dropped almost two degrees. Imagine a Laki erupting every year for hundreds of thousands of years."

Each scientist I met left me thinking that he or she was a clue or two away from solving the crime. But as Doug Erwin of the Smithsonian cautioned me, "the truth is sometimes untidy." The Permian extinction reminds him of Agatha Christie's *Murder on the Orient Express*, in which a corpse with 12 knife wounds is discovered on a train. Twelve different killers conspired to slay the victim. Erwin suspects there may have been multiple killers at the end of the Permian. Maybe everything—eruptions, an impact, anoxia—went wrong at once.

Could it happen again? "Sure," Erwin replied. "The question is when. Tomorrow? A hundred million years from now?"

I left Erwin's office at the Smithsonian and wandered into the dinosaur hall. Behind the dinosaurs was a case with skulls of Permian synapsids. They don't get many visitors. *Lystrosaurus*, the synapsid that inherited the barren world of the Triassic, stared out empty-eyed. With its competition gone, *Lystrosaurus* spread across the world, from Russia to Antarctica.

Death creates opportunity. Survivors occupy vacant niches. Within a million years synapsid diversity recovered. One lineage produced our ancestors, the first mammals. Now we are creating a new mass extinction, wiping out countless species. Will life be as resilient this time? I remembered the acid-tolerant plants of the Black Triangle, where we've done so much to destroy an ecosystem. If life can survive the Permian extinction, it can survive anything. □

MORE ON OUR WEBSITE

Is another mass extinction looming in our future? Share your thoughts in our forum at nationalgeographic.com/ngm/0009.

“W

Talle Valley Camp, 8:00 p.m.

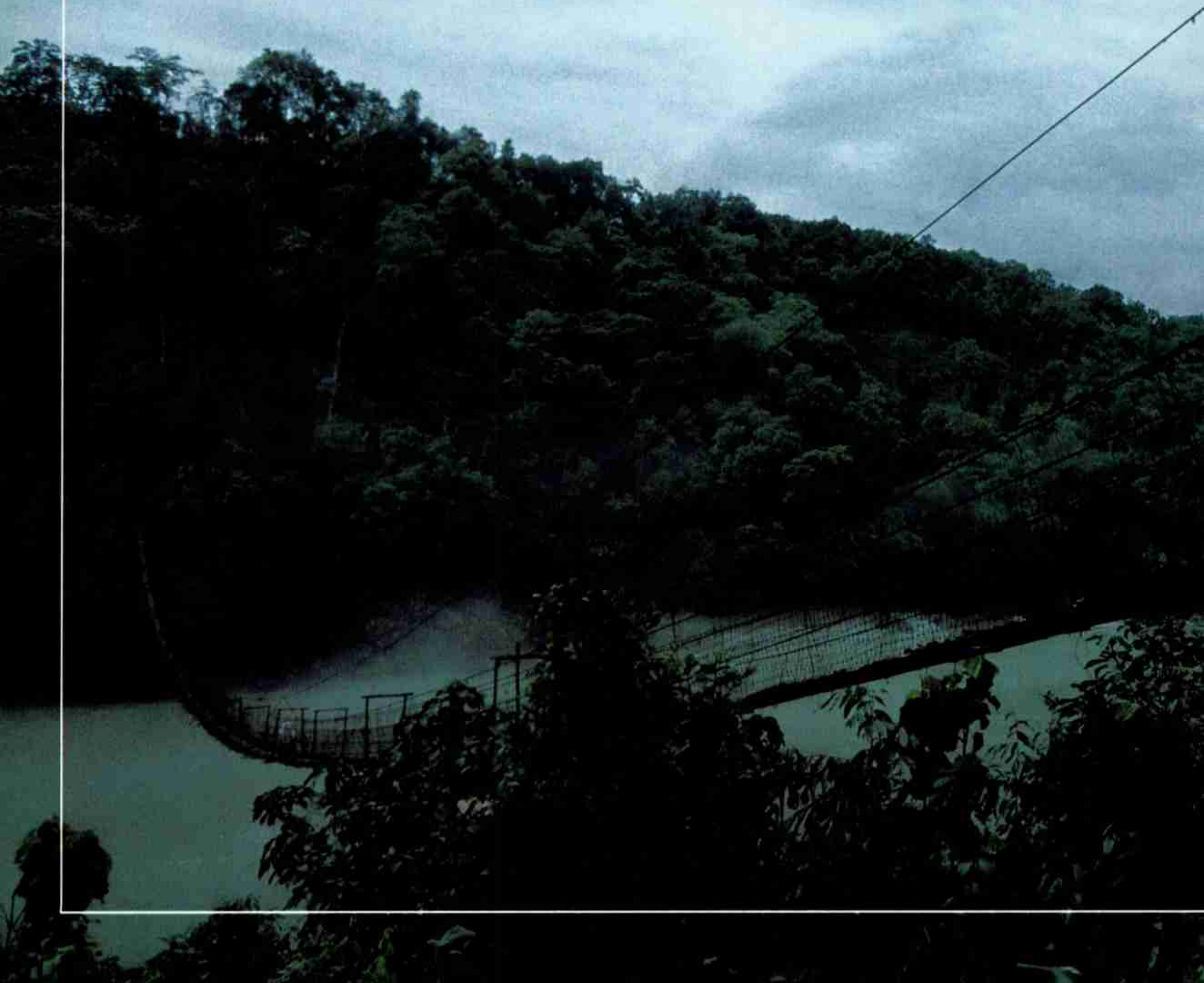
HEN THE OLD PEOPLE EAT THE RATS, they leave nothing.” Nani Sha, range officer of the Talle Wildlife Sanctuary in northeastern India, is explaining the eating habits of his tribe, the Apatani. “Rats like these are not found outside Talle. People walk for days just to eat them. For me, I prefer not to eat the skull, but its brain I do take.” Sha leans against a log by the fire as he talks, pausing to drink rice beer from a tin cup, then lighting a cigarette with a burning stick.

“Talle Valley rats,” Bulu Lampung, the sanctuary’s forest guard, says

IN SEARCH OF THE

BY JESSE OAK TAYLOR-IDE

Youthful zest and jungle smarts equipped the author, at age 17, for a great quest: tracking and photographing the elusive clouded leopard in its Himalayan realm. For Jesse, here crossing the Dihang River in northeastern India, the project was not only part of a wildlife survey he helped conduct, it was also in keeping with a family legacy of environmental activism and social service.



proudly. He gestures toward several short, stubby creatures with thick brown fur lying beside Hibu Chama, the young Apatani who will cook our dinner. “Talle Valley” rolls off his tongue as one word, delivered with the wide smile Lampung reserves for anything worthy of association with this place—such as the Talle Valley chair he once made with bamboo stalks for my father; Talle Valley tea, his personal blend of black tea and dark rum; Talle Valley stomach, another Lampung specialty, consisting of a chicken’s stomach mixed with egg and cooked in a piece of bamboo; and, of course, Talle Valley rats, which the Apatani consider in a league of their own.

We’re an unusual group: two wildlife officers of the state of Arunachal Pradesh, both

CLOUDED LEOPARD



Apatani born and raised in the jungle; the “boys”—six young Apatani hunters; and me, a 17-year-old American raised on Himalayan expeditions. We’re camped at 7,800 feet on a plateau in the heart of the Talle sanctuary—130 square miles of some of the wildest jungle and cloud forest left on Earth. Thick bamboo carpets the valley floor. At night, birds—the mountain scops owl and the large hawk cuckoo—call in the trees above, while somewhere below, unseen and unheard, a hunting cat stalks its prey.

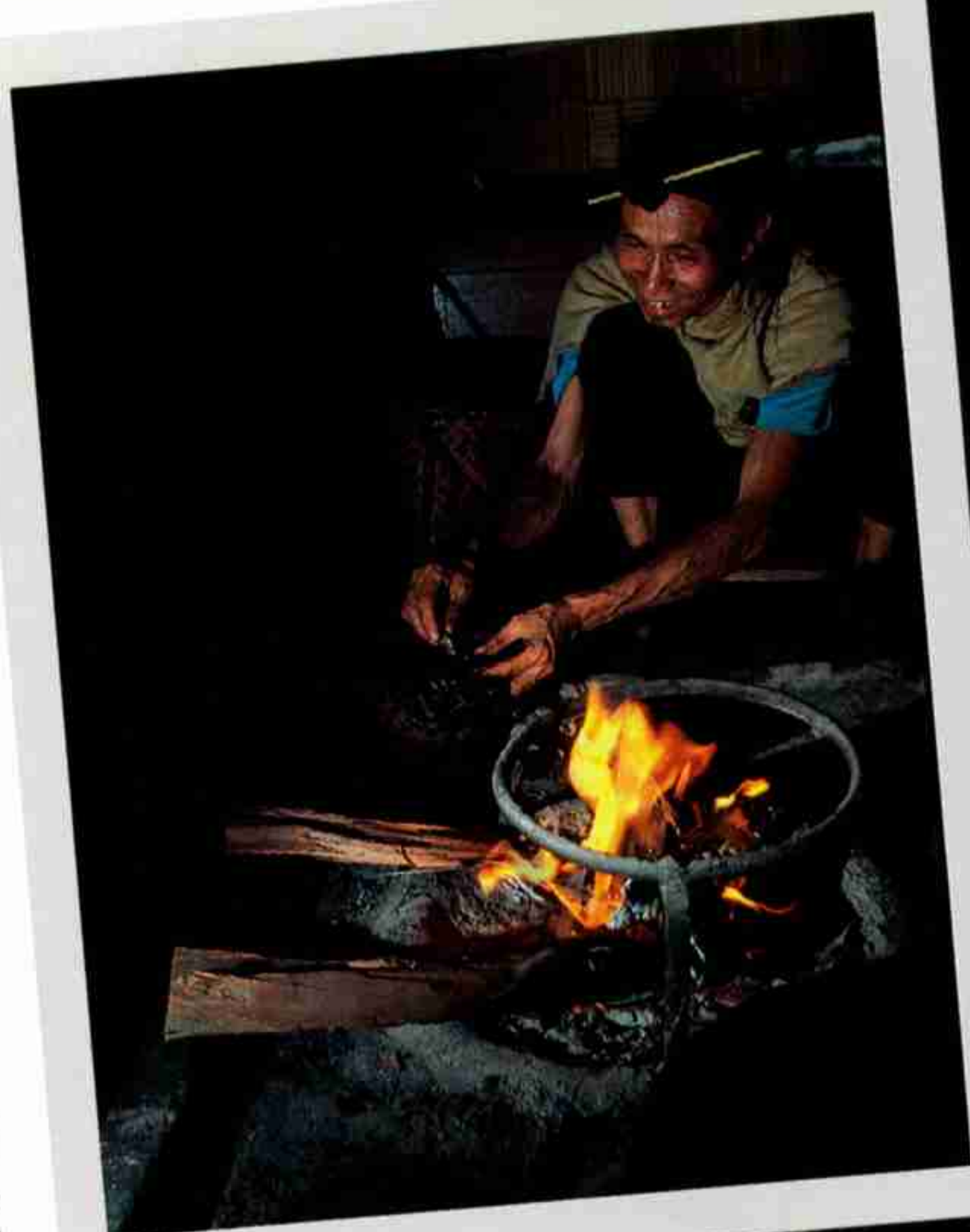
We’ve come to Talle for six weeks to set up a network of 18 motion-sensing cameras on jungle trails. The battery-powered cameras run unattended for days at a time, providing an effective way to document animal life in remote, difficult areas. Our survey is part of a larger initiative facilitated by Future Generations, a nonprofit organization based in Franklin, West Virginia, to encourage local people in Arunachal Pradesh and across the border in Tibet to improve health care and education in their communities and to manage their forests, wildlife, and other resources in a sustainable manner.

Nani Sha and I are also engaged in a personal quest: to capture on film the elusive *Neofelis nebulosa*, the clouded leopard. This magnificent cat takes its name from the cloud forest it inhabits and the hazy markings that allow it to blend with the shifting shadows of the jungle canopy.

MY FAMILY’S CONNECTIONS to the Himalaya go back to my great-grandfather John C. Taylor, Sr. In 1914 he gave up broncobusting in Dodge City, Kansas, leaving the cowboy life to become a medical missionary in the Indian jungle. He lived in northern India for 54 years, teaching my grandfather—while skinning a tiger—the anatomy lessons that would get him into Harvard Medical School. My parents spent many of their formative years in the Himalaya, and I have grown up hearing stories of hunting man-eaters, climbing mountains, and exploring rivers. The stories melded entertainment with education. They prepared me to face similar situations on my own adventures.

Watching Chama cooking the rats brings past meals to mind. I was nine when Dad, my grandfather, and I drove across the Tibetan Plateau to Mount Kailas, a sacred peak. We were looking for KyiApsos, the rare bearded sheepdogs of the Tibetan nomads. For weeks I lived on little besides Spam and crackers because I couldn’t stomach the weird food.

“The boys are really happy that you will get a chance to taste Talle Valley rats,” Sha says, as Chama, squatting by the fire, slides the prized rodents onto bamboo skewers and lays them on the glowing coals. The hair sizzles and burns, leaving black bubbles of skin. Woodsmoke, now acrid with the tinge of burning hair, stings my eyes as a gust of wind blows it in my face. A barking deer calls in the darkness, warning the



“The leeches are so smart they do not let us rest even when we take a bath.”

—NANI SHA
RANGE OFFICER

Roasted rat, as prepared by farmer Nani Pugang, is a local delicacy. Though never one of Jesse's favorite dishes, rat became part of his diet while he was in India. The expedition braved leeches, heat, violent storms—and, in Jesse's case,



BOTH BY DANIEL TAYLOR-IDE

duckings—to set camera traps in the Talle Valley of Arunachal Pradesh. They hoped to document the region's wildlife, including the clouded leopard, a rare and endangered species.

jungle that a predator is on the move—or perhaps it is warning of our presence. The darkness closes in around us, with no stars or moon visible through the low-hanging clouds, and the wind carries the mountain chill of the eastern Himalaya.

Chama chooses a rat and, after scraping off the blistered skin with a stick, passes it to me. The meat has a strong, gamy flavor like the squirrels we hunt at home in West Virginia, and the tiny bones crunch like burnt popcorn. A rat's flavor varies with its diet, and among the Apatani it is acceptable to take three or four rats from someone else's trapline (as long as you leave them with a good catch) to see how you like the taste of rats from that location. The jungle belongs to everyone, so any Apatani can set his traps anywhere he wants, as long as someone else hasn't gotten there first.

A rhododendron thicket north of Talle Camp, 8:30 a.m.

TRUNKS AS THICK AS A MAN'S LEG support rhododendron branches that twist around one another into a low canopy enveloped in mist, which disappears as the sun rises but can still be felt, like a memory, drifting through the leaves. Moss and hanging lichen cover trees interspersed with bright red, white, and pink rhododendron flowers. Walking through this jungle is like stepping into the imagination of J. R. R. Tolkien—no wonder the Apatani think Talle is haunted. I finger the woven bamboo bracelet a shaman of the Adi tribe gave me for protection. Are these strange jungles a reflection of the spirits who live here? My Western mind tells me one thing, but the trees whisper another.

Much of Talle sanctuary is unexplored, even by the hunters who venture here from their homes on the Apatani Plateau, a day's walk to the west. Hunting is forbidden to outsiders, but the Apatani come not only for the rats but also for squirrels and other small game. They prefer to leave the forest by nightfall so as not to provoke the spirits—*bhoots*—and little elfin men like leprechauns who inflict deathly luck on anyone who catches sight of them.

Besides the Apatani, Arunachal Pradesh is the home of scores of tribes and subtribes that speak many languages and dialects. The Talle Valley lies on the far side of the “inner line,” which dates from the days of the British raj, when the proud tribes refused to submit to the might of the empire. Although the tribal peoples now welcome contact with the outside world, India severely restricts access to Arunachal Pradesh, much of which is claimed by China. It remains one of the most closed regions in Asia. Several times I entered villages and valleys where no Westerner had ever been before. In recent years only a handful of scientists have visited Talle, and efforts to catalog its many rare bird and plant species have been hampered by the dense jungle and severe weather, in which a blazing hot sun can give way in minutes to a raging thunderstorm with hail the size of marbles.

Lampung suddenly drops to his haunches for a closer look at a set of pugmarks in the soft loam. Leaning on his rifle, he bends to sniff the massive print. He turns to where I'm squatting beside him, a strange light in his eyes. “Tiger.” He bares his teeth in a snarl, followed by a grin.

"He came this morning." Lampung pats his rifle, but I can see the awe behind the smile. Tigers have a supernatural quality here; the Apatani believe they are the most powerful beings in the jungle. "*Chalo*," he says—"Let's go."

"What have you got?" Sha asks, coming up behind us.

"Fresh tiger pugmarks," I reply. "I think we should set up a camera trap." Lampung lays his rifle to the side and begins clearing a space so that no leaves or branches will blow across the camera's sensor. "It seems we are now all becoming experts," Sha says with a laugh. "For Lampung and me it is really something to be setting traps for tigers. It has been many years since our people hunted them."

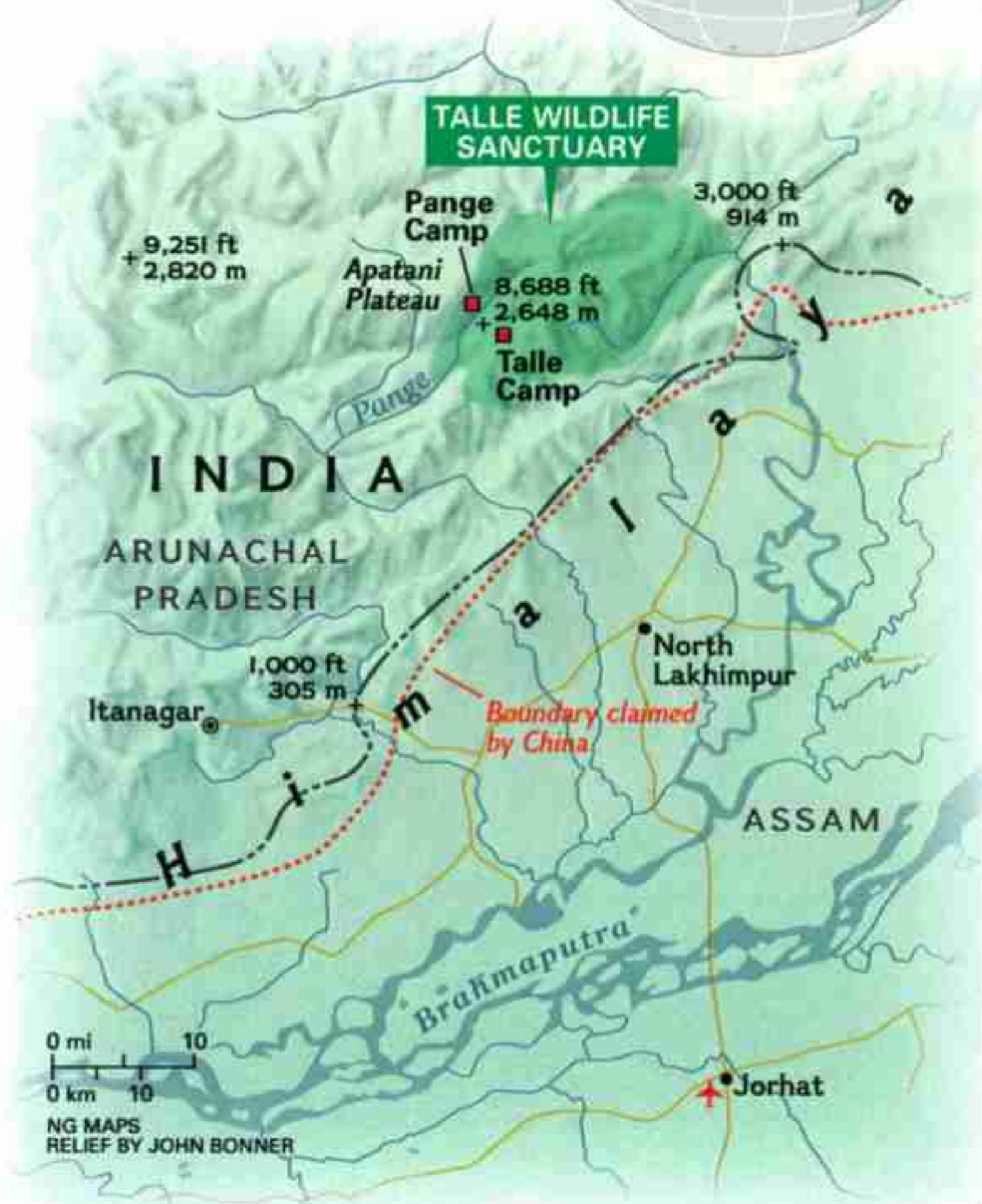
WE MOVE ON and at the top of a steep shortcut break out onto the open trail, sweating and out of breath. Two old men sit cross-legged in the shade. They're lashing together four saplings about seven feet long with cords they've just made by stripping off the outermost layer of bamboo stalks with their *daos*. The dao, a long knife like a machete, is an extension of an Apatani hunter's arm, used to make most anything out of bamboo, cut a trail, or defend himself from an animal or enemy. The two men, who seem to be friends of Lampung's from the Apatani Plateau, will transplant the saplings in fields near home. The Apatani are establishing experimental tree plantations to find the best wood for fuel and timber.

As we sit with them beside the trail unpacking our lunch of chapatis and curried vegetables, Sha explains that the Apatani stopped hunting tigers and other cats long before 1975, when it became illegal to trade them under the Convention on International Trade in Endangered Species (CITES). "In the time of my grandfather the men would set traps on the trails used by the cats, just as we do with our cameras. The traps were armed with spears made of a poisonous bamboo that grows on the other side of the Apatani Plateau. The hunters got so good at setting their traps that they could look at a cat's pugmarks and know just where its heart would be, just as we must look at the pugmarks to know how high we must aim the beam for our monitors. Young men hunted the tigers to show how brave they were, and eventually they killed so many that they upset the balance of the jungle."

Today, Sha says, the Apatani are serious about protecting wild cats. "The tiger is the brother of the human being. To kill a tiger is equal to murder, but to kill any cat is a serious offense. When an Apatani kills a man, he can't keep the secret to himself—he must perform a *puja* to cleanse himself of the sin. The same goes when he kills a tiger or another cat." A *puja*, Sha says, is a complicated affair. "Every man in his clan participates. The men must run around Nago, a sacred place of the Apatani, and make a leap over the skin of the cat, from head to tail, without



Geography and geopolitics keep the Talle Valley in splendid isolation. Its peaks, forests, and wild river gorges make up a wildlife sanctuary to which the Indian government strictly limits access. The preserve also lies within a region of India claimed by China.

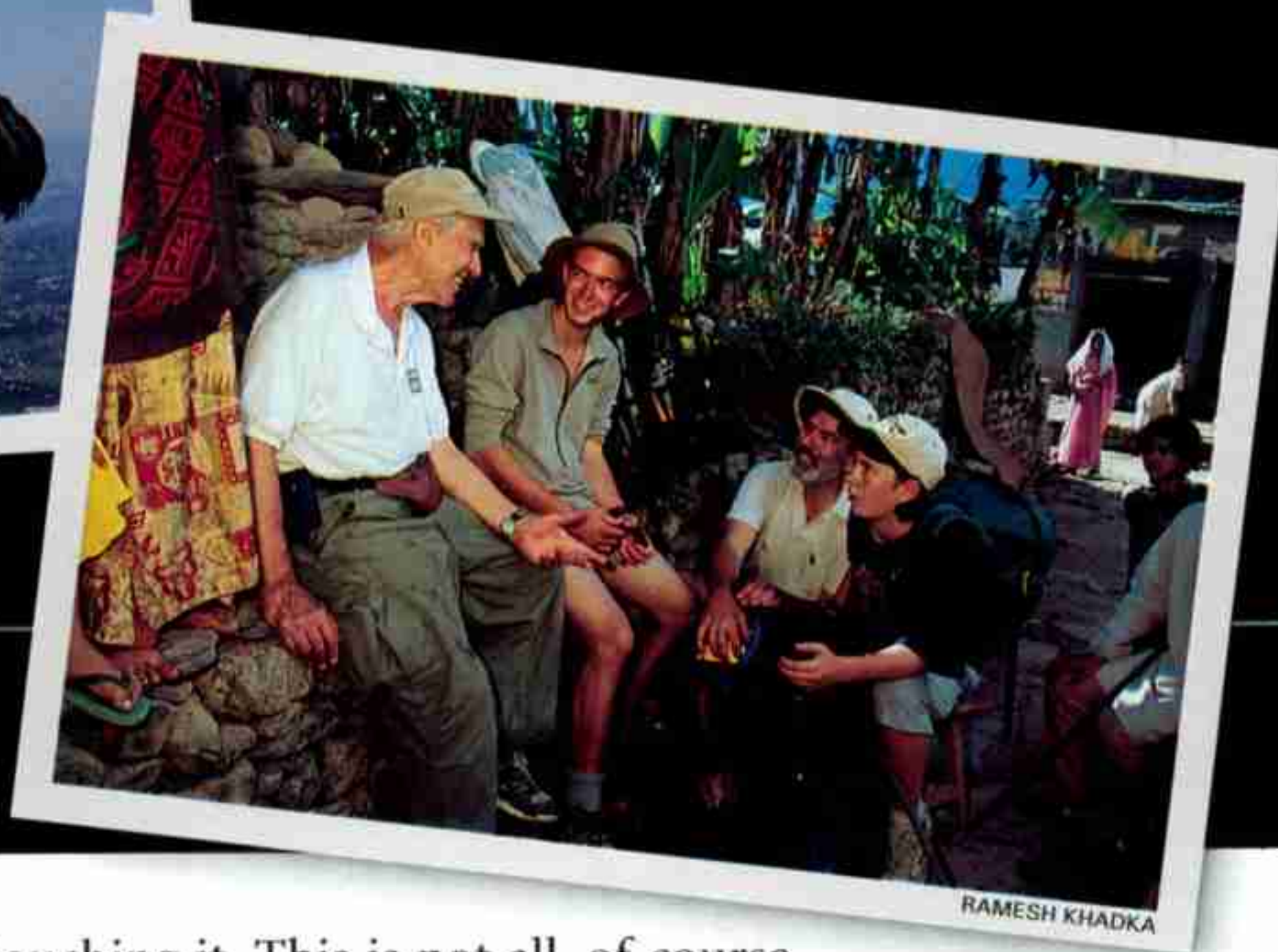


Conservation: A Family Affair

In 1914 John C. Taylor, Sr., left a cowboy's life in Kansas, traveling with his wife to India, where they both became medical missionaries. "They ran clinics in the Himalayan foothills for 54 years," says grandson Daniel. Daniel's father, Carl Taylor, also became a doctor and conducted health surveys in Bhutan, Nepal, and Tibet. Today Daniel heads Future Generations, an organization that works with South Asian communities on health care, education, wildlife protection, and sustainable economies. Jesse and his brother, Luke, continue the tradition by helping local people monitor the health of their ecosystem.



JENNIFER TAYLOR-IDE



RAMESH KHADKA

A cattle-killing tiger was shot in India in 1956 by Jesse's great-grandfather John C. Taylor, Sr., to protect local villagers. In Nepal five-year-old Jesse appears to fly like the prayer flags when tossed by his father, Daniel Taylor-Ide. In a Nepalese village in 1999 Jesse's grandfather Carl Taylor relates his own Himalayan experiences to Jesse, Daniel, and Jesse's brother, Luke.

touching it. This is not all, of course.

The man must entertain his entire clan. The puja will cost at least 30,000 to 40,000 rupees." (Considering that jungle rats sell for about ten rupees apiece, this is a small fortune.)

The Apatani, mainly farmers, are a small, relatively peaceful tribe. With the coming of modern medicine and birthing practices, Apatani death rates have dropped dramatically, and their population is expanding. Scarcity of land on the Apatani Plateau is forcing many of them to leave, and there is growing pressure to settle the hard-to-cultivate Talle Valley and other parts of the sanctuary. Meanwhile hunters armed with shotguns rather than the traditional bows and slingshots are taking a toll on wildlife throughout the state. But Nani Sha, Lampung, and our Apatani guides know their world is threatened. So they're putting their age-old arts of tracking, hunting, and jungle lore to new use—protecting the animals they used to kill.

"Hey! Look at this!" I call to my companions, bending to pick up a scat a bit shorter than a Baby Ruth bar. Breaking it in half, I sniff the moist ends. It has a pungent odor reminiscent of a cat's litter box.

"Clouded leopard by chance?" Sha wonders, also sniffing the scat. "I think it must be; it is far too small to be tiger, and it is definitely one of the cats. I suppose it would be easy to set a unit in this sandbank."

We calibrate the cameras for the chest height of the animals we want to record. When a camera is running, we avoid the site for at least three days so as not to disturb the animals. We then return to change the film, check the batteries, and perhaps move the unit if it has not recorded any activity or if we need it for a more promising site.

"Snake!" Chama calls in alarm. Sha spins around to look at the embankment. "Jesse, a snake is here if you want to get a snap. It ran right between my legs just now." I hurry forward, pulling my lens cap off. The snake is hidden among the vines covering the small sandbank, but the Apatani probe with their bamboo walking sticks and flush it out of the weeds. Looking through my viewfinder, I crouch and move in closer. A little closer. . . . The snake strikes, its fangs closing on empty air just as I wind the film. I get a few shots, and the hunters quickly pounce. They cut off its head and bury it, throwing the body into the jungle. The Apatani believe a snake's eyes are like cameras, seeing whoever it was that killed it. If the head is not cut off and buried, the snake will return for revenge. So deep is their fear of snakes that even sanctuary guards whose job is to protect life will kill a snake.

Pange Camp, 5:30 a.m.

YESTERDAY we had a visit from Pekyom Ringu, the deputy chief wildlife warden of Arunachal Pradesh. "That was a mountain pit viper," he said, explaining why the men wasted no time in killing the snake. "Had it bit you instead of striking at your camera, you would only have time to say, 'I leave my boots to him, my dao to him, my Swiss bank account number is such and such. . . .' And that would be the end. My man, you would be dead within five minutes."

This morning I'm sitting outside my hut in Pange, sipping tea and preparing the camera units we will set today. The dew glistens on the high grass and trees surrounding the camp, reflecting rays of sunlight through a thousand tiny prisms. The mist, rising gently off the hills and ridges, reveals the thick jungle canopy and huge ferns crowding in the shade of the trees.

Lampung, wearing flip-flops and a long red cloth wrapped around his waist like a skirt, is squatting on some rocks in the middle of the stream below camp, emptying the fish traps for our breakfast. Sha sits beside me on a folding chair, enjoying an early morning cigarette after a bath in the river. A strong man with a quick sense of humor, he too wears flip-flops, crammed on over his socks, which are pulled up to cover the cuffs of his pajama pants to keep out the leeches. "The leeches are so smart," he says, his voice breaking the morning reverie, "they do not let us rest even when we take a bath." When Sha doesn't have a dao in his hand, he walks unburdened except for a water bottle and cigarettes, often with his hands clasped calmly behind his back like a man out for a stroll.

The day's work begins. Our guide is Takhe Chatung, an old Apatani



Are these
strange
jungles a
reflection
of the
spirits
who live
here?

man who knew a hunter from Lampung's clan who claimed to have seen three clouded leopards asleep in a tree. He said the leopards stole 18 of his rat traps, carried them some distance to the tree, and ate all the rats but left their heads in the traps.

The old man leads us through the jungle for hours, following a roundabout route that allows him to check his traps—and collect half a dozen rats. We walk in the middle of a streambed. The rocks are slippery underfoot, threatening to send me and several thousand dollars' worth of camera equipment flying. But sloshing through the water is better than hacking through thickets where thorny bamboo grows inches apart. I have bamboo scars on my arms and knuckles I'll probably carry to my grave. I'm suffering from a fever and a nasty rash on my legs, and the cool water feels good rushing around my thighs. Occasionally I dip my swollen hands into it with relief.

At last we reach the leopard tree. It's huge—at least a hundred feet tall—and so densely covered with vines that the trunk is invisible. Two hours later we have placed a monitor and camera about 50 feet up on a large branch with claw marks on it.

As we move on down the trail, Takhe Chatung speaks of the clouded leopard's arboreal talents,

how it leaps through the trees chasing monkeys. He claims it can jump three times its body length (tail included) from tree to tree, a distance of about 20 feet.

With a very long tail for balance and large paws for climbing, the clouded leopard is well suited to life among the branches. It also has the longest upper canines proportional to its skull size of any living cat, reminiscent of the saber-toothed cat. Those teeth would work well for grabbing monkeys out of the branches or snagging pheasants from above.

Like other animals, clouded leopards seek out places where fallen logs make natural bridges across the many streams that weave through the jungle. Such crossing places are some of our favorite camera sites. Ten miles or so from the big tree, six feet below where I sit in the fork of a log, the Pange River, swollen by the late monsoons, rushes through the nearly impregnable jungle. My canvas shirt clings to my rain-soaked skin, and rivulets of water run off my hat and down my back. Mumbling vulgarities at the water running into my eyes, I set my hat on the log beside me and try to carve a niche for the camera unit in the fork with my bowie knife.

"It seems that it would be easier to attach the unit to a pole running up behind the log?" Sha calls to me from the bank.

"Much," I grunt, shifting my weight to ease my cramped knees. "If there were a pole running up behind the log." Without a word Sha cuts a long branch at the base of the log and wades into the river. Knee-deep in the torrent, he holds the branch in place while I lash it to the log with a rat-chewed, unusable length of camera cable. Once we get Sha's pole in place, it takes only a few minutes to position the infrared monitor on it and strap the camera on its little plastic tripod to one of the bamboo stalks reaching out over the river. At last we can head back to camp.



Plants of the banana family grow jumbo blossoms in Arunachal Pradesh's pristine jungle. Local tribal people eat banana blossoms and use the leaves as

umbrellas, roofing, and dinner platters.

Thorns protrude from a bamboo shoot, poised to gouge the flesh of jungle trekkers, as they did Jesse's. Arunachal Pradesh is 90 percent forest and mountains; 40 percent of India's bird species are found there.

The old man steps onto the log, his bare feet gripping the slippery surface easily. Soon he is on the other side. The others follow. It's my turn. My boots have never felt as clunky as they do now. The log is a huge ficus tree. To cross, I have to negotiate one of the root buttresses that give the ficus its distinctive appearance. Suddenly my foot slips from under me. I grab for the log as I fall, and wrap my arms around it. I'm swinging above the river, the 50-odd pounds of equipment threatening to drag my arms free of their hold, as I watch my walking stick disappear in the water. With a heave, I throw one leg onto the log and haul myself back onto my feet. It's been a long day.

As it turned out, the camera in the tree yielded nothing, but our sloshing downstream paid off with an image of a clouded leopard crossing the Pange. When I first saw it, flipping through slides at National Geographic headquarters, I sat still for a moment, without breathing, looking at the cat's eyes shining brightly in the reflection of the automatic flash. This cat was more beautiful than those I had seen in the zoo in Itanagar, because it was as wild as the jungle. Beautiful too because its very existence signals the health of the jungle. The clouded leopard thrives in old-growth jungle with mature trees to support its weight, and it depends on an interconnected web of monkeys, pheasants, otters, and rats—all recorded, along with many other animals, by our cameras.

We showed the pictures at a seminar on the future of Arunachal Pradesh in Itanagar, the state capital. Omak Apang, then India's minister of tourism, and other top officials in the national and state governments were present. The whole room applauded when the clouded leopard appeared. The photograph had been taken by their man: Nani Sha. The task of documenting Arunachal's natural abundance goes on, and as I prepare for my sophomore year of college in the United States, Sha is loading up the cameras for another expedition.

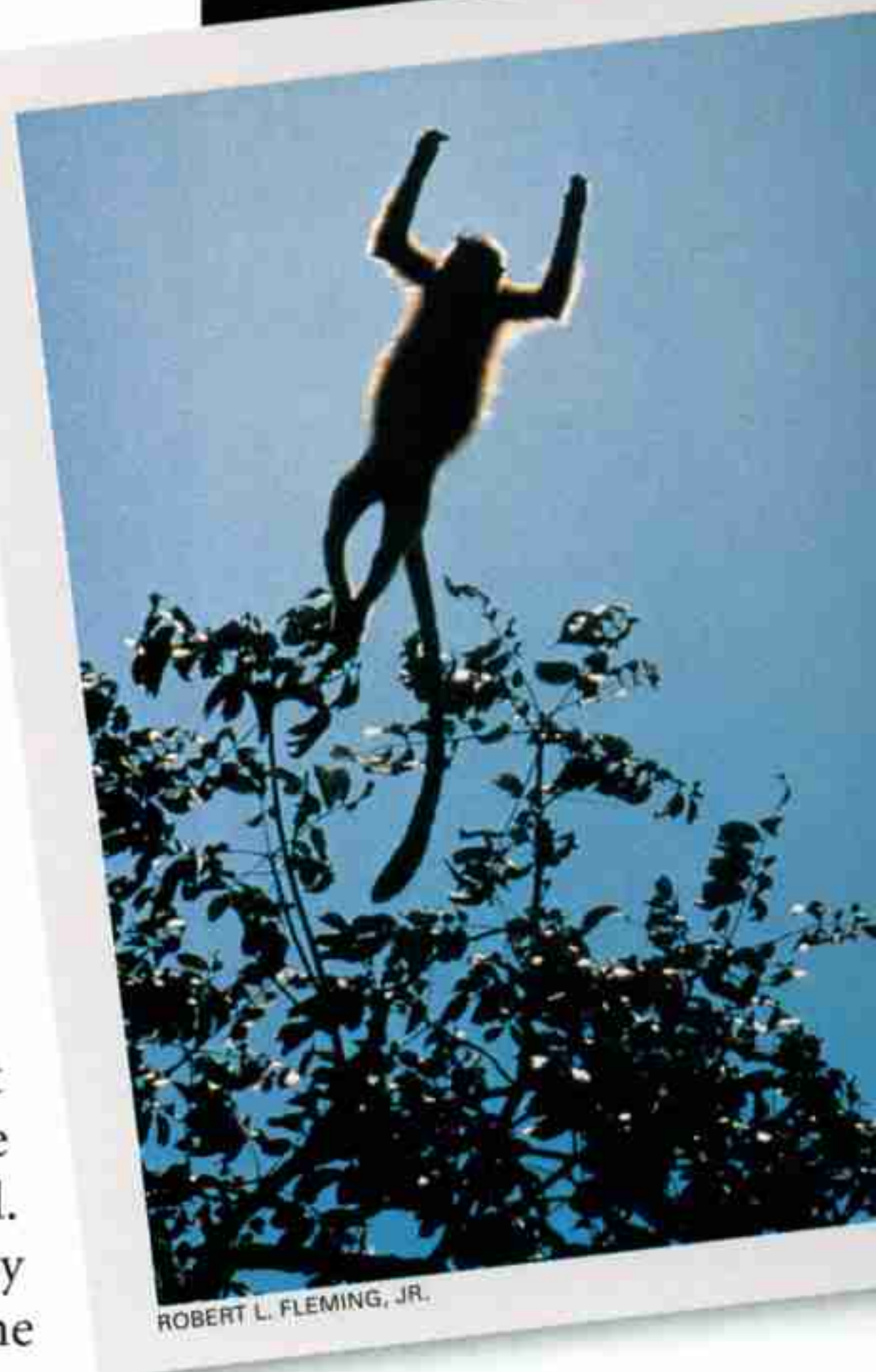
The clouded leopard's very existence signals the health of the forest.

Pange Camp, 8:30 p.m.

A VINE, UNSEEN IN THE DARKNESS, catches on my gear and throws me off balance, threatening to send me tumbling down the mountainside. I lash out with my knife, trying vainly to reach the vine behind me. It snaps free. Ahead of the small circle of light illuminated by my headlamp, Lampung's back slides through the bamboo without a glitch. Not carrying a heavy pack with a tripod that catches on every possible piece of underbrush, he swings his dao with casual efficiency that buys him twice the results my fevered hacking earns me.

Finally we reach the open trail, and I sheathe my knife. In the peace of walking on an open trail, I feel a leech on my stomach. With a jerk I divest myself of the wet body and try to flip it into the woods. The little guy isn't having any of that and clings onto my fingernails until I scrape him off on a piece of bamboo.

We arrive back at Pange Camp. Groaning with exhaustion, I set my pack on my cot and lean back against it. My shoulders tingle with the weightless feeling that follows carrying a heavy load. Opening the front of my shirt, I pull five more leeches from my chest and stomach. As I'm changing into dry clothes, exulting in the





NANI SHA

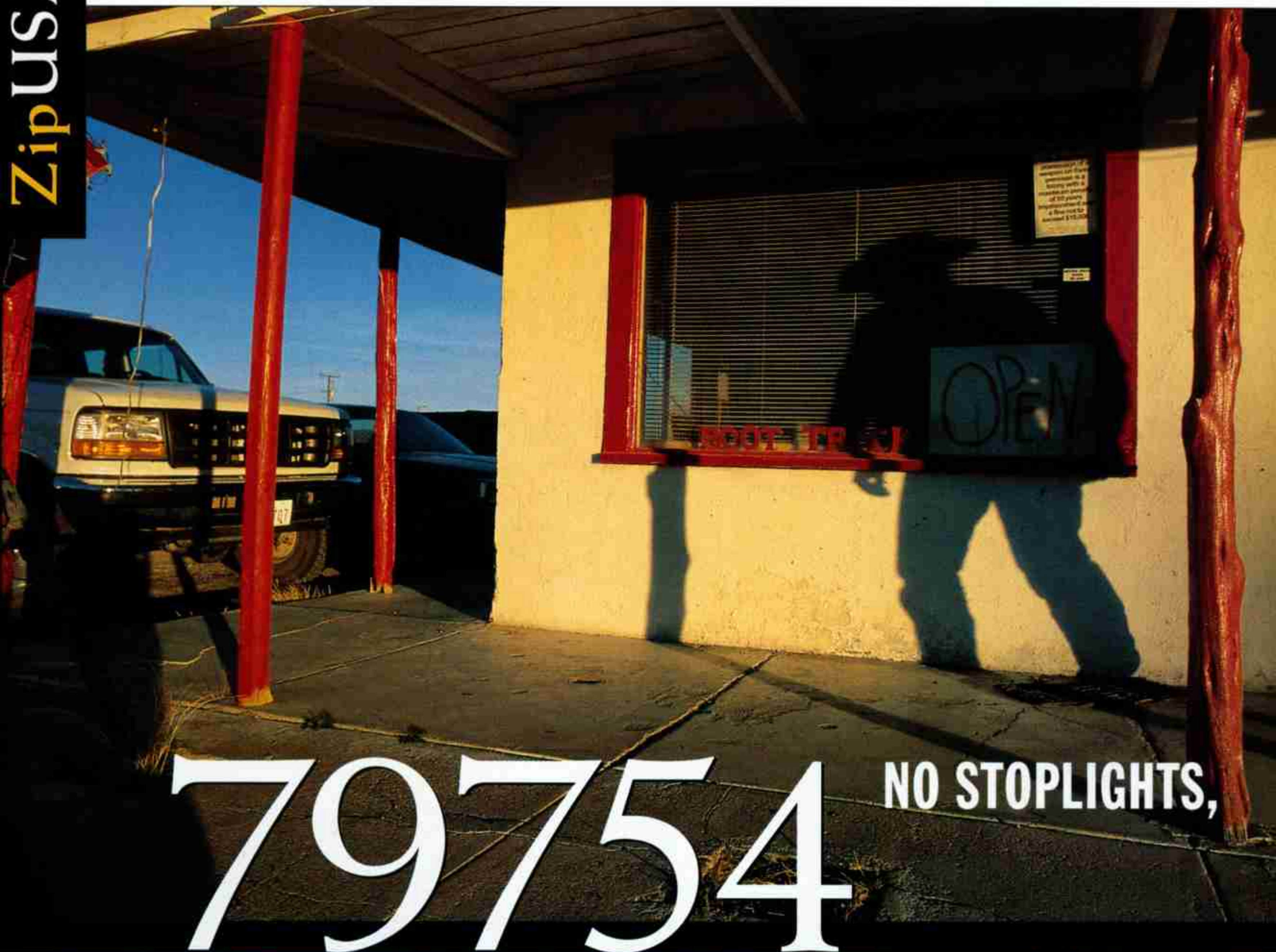
Success! After six long weeks a clouded leopard—eyes blazing in the flash—trips the shutter, making a memorable self-portrait. The capped langur (left) is leopard prey, but its future is less murky than that of the magnificent predator that stalks it.

comfort of soft flannel after the rough canvas of my trail clothes, Sha calls from the next room, “Perhaps you could sit by the fire and take a little peg of whiskey?”

“Thanks,” I call back. I spread a collection of sodden slips of paper from my wallet out on my cot to dry: names, phone numbers, addresses. Each one is a memory of home—somewhere I had been, a friend, someone I had known for a day or met one night. They are pieces of my other world so far away. Lampung’s words, spoken earlier that day, run through my head. “In the jungle Jesse is more Apatani than American.” He had meant it as a compliment, and sometimes it almost seems true. Pulling out my one issue of *TransWorld Snowboarding* and the headphones that I carried halfway around the world, I slip away to visit what I’d left behind. But soon I’m sitting beside the fire with a cup of watered-down scotch in my hand, watching Sha shuffle the cards for another hand. □

MORE ON OUR WEBSITE

Visit Arunachal Pradesh on the Web and learn more about wildlife conservation at nationalgeographic.com/ngm/0009.



79754 NO STOPLIGHTS,



Rancher John Allgood's shadow falls on the Boot Track Cafe. A mirror reflects the old schoolhouse. Downtown and environs: a buzzard's-eye view. Sheriff Richard Putnam and his wife, the postmaster, get going.



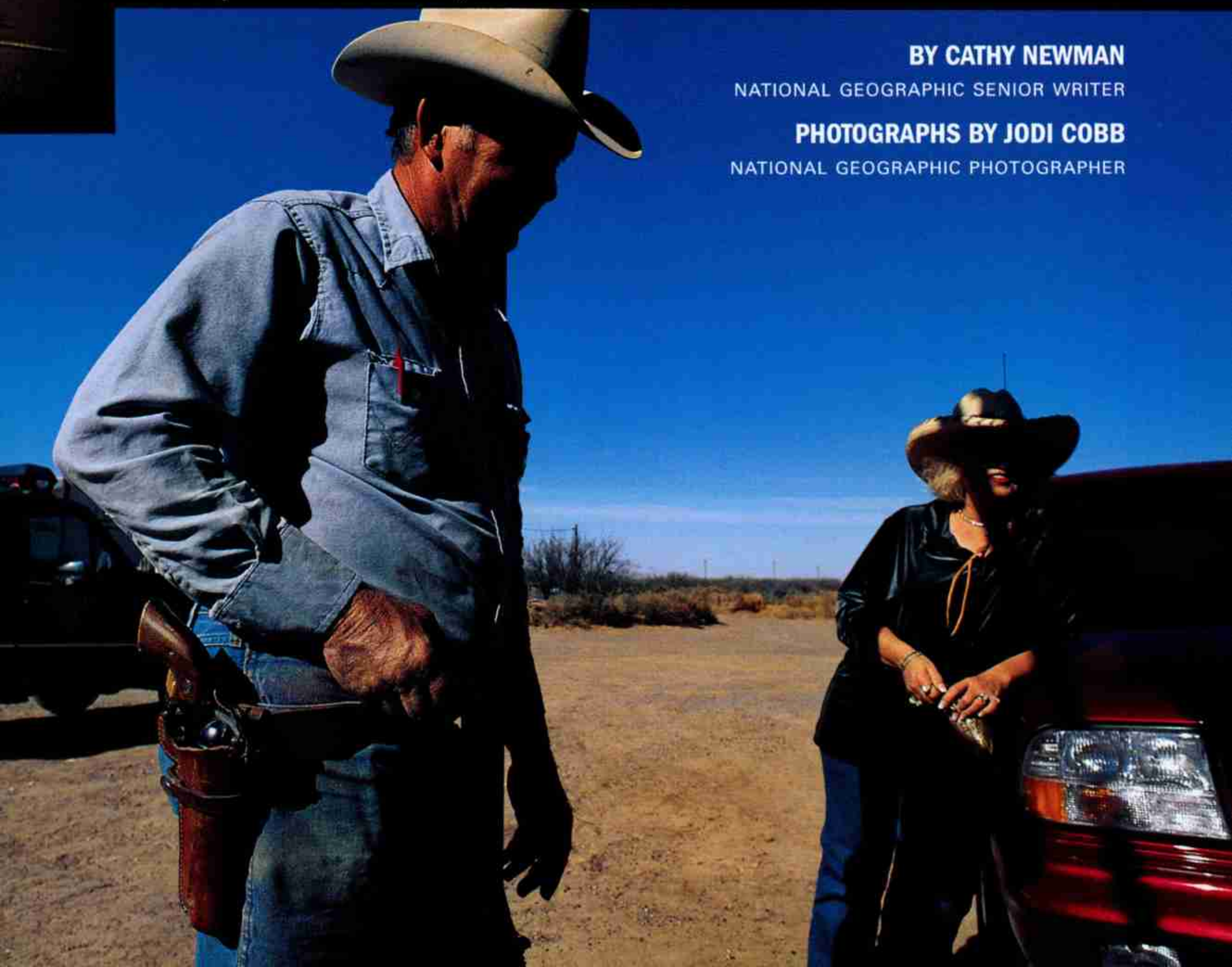
ONE CAFÉ, 15 PEOPLE, 674 OIL WELLS . . .

BY CATHY NEWMAN

NATIONAL GEOGRAPHIC SENIOR WRITER

PHOTOGRAPHS BY JODI COBB

NATIONAL GEOGRAPHIC PHOTOGRAPHER



Let me tell you about a town I like that sits smack in the middle of furnace-hot desert with oceans of oil below ground and not much to speak of above.

Mentone (population 15, more or less) is the county seat of Loving County, Texas. It's also the only town in Loving County, the least populated county in the 48 contiguous United States. You can drive through Mentone in 12 seconds flat and not even stretch the speed limit. You pass the post office, the Boot Track Cafe on the left; the courthouse, a gas station on the right. You've left the town behind; sand and prickly scrub lie ahead. The terrain is griddle flat; on a clear day, which is almost always, you can see the Davis Mountains 75 miles to the southwest.

Even so, Mentone is not unlike the town you or I live in. It may look different on the outside, but on the inside passions run the same. It's just that the sparse landscape and population render the clockworks of Loving County transparent. With so few trees around, you can see the forest for what it is.

Let us count Loving County's blessings: one elevator, two stop signs, and 674 oil wells. Other blessings: no stoplights and no lawyers.

There's not much water to speak of in Mentone. Until 1988 drinking water was trucked in from Pecos, 23 miles away. Now the county has its own well, but even so, water is limited in quantity and quality. Mentone water is so mineral laden, pipes clog and lawns curl up and die.

Loving County has about 70 residents; most meant to stop briefly but got alkaline in their blood and stayed. "When I came to Mentone, I asked my husband how long we would have to live in this godforsaken place," Mary Belle Jones told me. "Just a few years," her husband,



79754

POPULATION:

70 Loving County

15 Mentone

ANNUAL RAINFALL: 8 in

SQ MILES: 648

SQ MILES PER PERSON: 9

STORES: None

HOSPITALS: None

CEMETERIES: None

NATURAL RESOURCES:

674 oil wells

74 gas wells

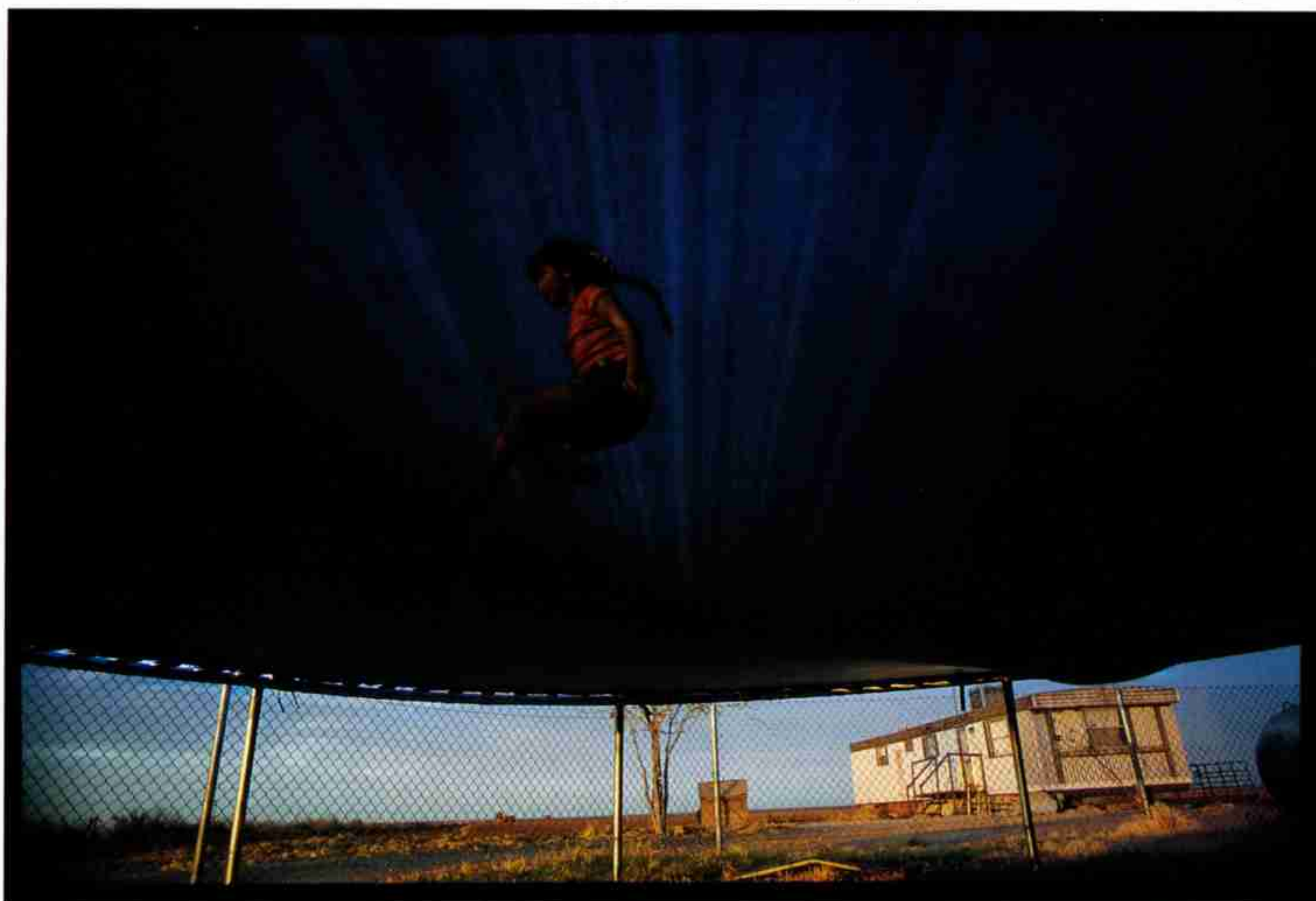
ATTRACTIONS: Automatic flagpole at the courthouse

NEAREST MOVIE THEATER:

75 miles

CHEESEBURGERS
SERVED PER DAY AT THE
BOOT TRACK CAFE: 25

The big game in town, a trampoline, is a thrill ride for the county's kids.



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who worked for Sinclair Oil, assured her. That was 47 years ago.

Social life revolves around the Boot Track Cafe, a ramshackle building with lipstick-red wood posts and a tin roof. Inside is a plank floor and tables where a bottle of hot sauce passes for a centerpiece.

Once when I stopped in, Mattie Thorp was lunching with her friends Mildred Crawford and Snooks Williams, who had driven down from Pecos. Mattie, 94 and a tiny sparrow of a woman, was nursing a pulled tooth. As usual, talk soon drifted to rain. In Loving County everyone has a rain gauge, and what precipitation there is (hardly any) is measured in hundredths of an inch. Mildred recalled the day she went out in the front yard and discovered it was raining; then she went out to the backyard and discovered it was not. Rain, like most things around here, is downright ornery.

Topic B at the Boot Track is the price of oil. Loving County sits on a huge limestone and sandstone sponge of oil known as the Permian Basin. When oil prices soared in the 1970s, a flash flood of tax revenue poured into county coffers, and the county decided to renovate the courthouse. "We did it up right," said County Judge Donald C. Creager. "We got the finest walnut paneling money could buy." Also, white stone flooring and a \$5,000 electronic flagpole that automatically raises and lowers the flag. But oil prices don't always stay high, and if the town doesn't figure out how to attract industry (difficult in a place with scant water), Mentone may dry up and blow away.

Which would be a shame. Where else is there a place where the county judge (Donald C. Creager) is brother to a county commissioner (Royce Creager) and father-in-law to the sheriff (Richard Putnam)?

Political apathy is unthinkable. Voter turnout is 100 percent. "Make that 150 percent," corrects Mary Belle Jones, a former county appraiser whose husband, Punk, is a former sheriff.

But Richard "Dickie" Putnam calls Mary Belle's estimate too conservative. He should know. As sheriff he also serves as voter registrar. There are 156 registered voters in the county: more than two voters for every person who actually lives there. It's absolutely legal. Proof of residence, even if you don't spend much time in the county, gives you voting rights.

Besides the Creagers and Joneses, the third dynasty in town is the Hoppers, descendants of original homesteaders. The three factions don't always see eye to eye. It's the usual squabble over money and power. As one resident put it: "Put three big bullfrogs on one lily pad, and there's bound to be trouble."

For an additional perspective, I visited with Lloyd Goodrich, who lives on the outskirts of town in a house with peeling white paint and

Charles Derrick grills cheeseburgers at the Boot Track Cafe.



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a decor best described as gothic junkyard. Lloyd, whose face looks like badly eroded plateau partly hidden by a Brillo-like beard, has a master's degree in engineering. When he graduated, you could only get a job on the East Coast or West Coast. He didn't care for either so just stayed home.

Loving County has its share of small-town petty, Lloyd admitted, but you'd find that anywhere. In the end, folks stick together. "Here you might not like somebody, but you go to the funeral," he said, then recited a poem:

*Me and my brother
We fight with each other.
But woe betide
The guy from outside.*

"Our Hatfield-McCoy stuff has settled down," Judge Creager said when I stopped by the courthouse to say good-bye. "Besides, in sickness and in death, Mentone takes care of its own." Over the past 20 years four houses have burned down, including Dickie Putnam's trailer, and each time the town collected enough money to help the owners rebuild.

A few years ago Janie Parker, the county auditor, got a call from a man with the state welfare department in Austin who asked why the county hadn't signed up for a program that provided funds for the indigent.

"We have no indigent," Janie patiently explained. There is no unemployment in Loving County. "But what if you did?" the man asked. After all, funds were there for the asking. "Suppose you did have folks who needed welfare," he persisted. "What would happen then?"

"Why, we'd all pitch in," Janie said. □

MORE INFORMATION

ON OUR WEBSITE There's more on Mentone at nationalgeographic.com/ngm/0009.

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Local character Lloyd Goodrich's storage system: 28 dishwashers, contents listed on computer.





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ONE THAT ALMOST GOT AWAY

Final Edit



79754: MENTONE, TEXAS

Willie Has His Day

That last pair of socks you can't cram into your suitcase. That piece of chocolate cake you can only groan over and pass by. That one great picture that just won't fit into the story—that dog, Willie, half Rhodesian ridgeback, half West Texas whatever.

Willie loves to ride out to the oil fields at 80 miles an hour in the back of Bryan Gray's pickup. "I can't con people to ride with me all day, but I've got him," says Bryan. Photographer Jodi Cobb snapped Bryan's truck-cab howdy to friend Paul Putnam outside the Boot Track Cafe. When photographing Mentone, says Jodi, "You're not worried you have to be somewhere else. You just wait for the picture to come to you."

MORE ON OUR WEBSITE

You can send this picture as an electronic greeting card at nationalgeographic.com/ngm/finaledit/0009.

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He's Getting the Lowdown

Following the trail of history

Belly down on the Bonneville Salt Flats photographing "The Way West," Jim Richardson was returning to his roots. As a kid he used to spend hours with his dad's old pawnshop camera shooting the patterns formed by the cracked mud of a dry Kansas creek bed, "when I should have been doing my farm chores." The salty web of inches-high pressure ridges in Bonneville's hard-baked

crust makes the place "paradise for a photographer," says Jim, who set up before sunrise to catch the ridges in their best light.

Jim's favorite part of this assignment was following the old pioneer routes himself—in a 4x4 vehicle. He's not alone in his enthusiasm. "Folks who seek out the old wagon ruts are known as 'rut nuts,'" says Jim. "I guess I'm one now too."

GNMENT

C O V E R I N G T H E W O R L D



JIM RICHARDSON

NEPAL

Part of the Family

It was like being accepted as a sister," says Canadian-born writer and photographer Debra Kellner, center, of living with the Rana Tharus in Nepal. She met them through her husband, French photographer and filmmaker Eric Valli, who first encountered the group nearly a decade ago and later lived with them for nine months.

The women took Debra to their hearts.

"They are among the most gentle people I've ever known," says Debra, here adjusting the



ERIC VALLI

traditional dress of Chanda, left, and her daughter Kurowa before Eric took their portraits.

This is Debra's first story for the GEOGRAPHIC. "Himalayan

Caravans," Eric's December 1993 article, grew into his film *Caravan*, which this year was nominated for an Academy Award as best foreign-language film.

PERU

Hanging In There

Wiltsie warms to a jungle expedition

His climbs had always taken place in cooler climes—Antarctica and the Himalaya—so photographer Gordon Wiltsie (below) wasn't sure what to expect while shooting "Lost Tombs" in Peru.

"I'd been assured that the cloud forests were free of toxic reptiles," he says, "so en route to the tomb I confidently grabbed vines knowing they wouldn't

bite. I didn't learn until later that the jungle was actually home to deadly snakes, as well as wild boars that attack unprovoked."

But he wouldn't have missed the experience for the world. "How many people get a chance to see a lost civilization in the jungle? That's the kind of adventure I dreamed about as a kid growing up reading the pages of NATIONAL GEOGRAPHIC!"



PETER LERCHE



NINA SABO

COLORADO

Made of Strong Stuff

He hesitates to compare his own personal fitness regime to that of Olympic weight lifter Shane Hamman (above, at right), but while covering "The Unbeatable Body," New York-based freelance photographer Joe McNally kept in shape with the traditional photographer's workout: the constant hoisting of heavy lights, cables, and camera cases.

McNally found athletes like Hamman "an inspiring lot. Their work ethic day after day is amazing." Yet, he adds, the world pays attention to sports like weight lifting only every four years.



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Flashback



THE UNBEATABLE BODY

Celebrating the New Moon

Lunar New Year observances at Saidaiji Temple in Okayama, Japan, traditionally include this feat of human performance. For a ceremony known as *hadaka matsuri*, a roomful of men grapple in total darkness to find camphor-scented batons tossed into the fray by the temple priest. "It is obvious," wrote photographer Horace Bristol, Jr., whose camera's flashbulb provided the room's only illumination, "that the participants in the ceremony must all be young, athletic, and in the pink of condition, for the melee is exceedingly fierce."

This photograph was taken shortly after World War II. It appeared in the September 1988 issue of the magazine.

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